COAL AGE

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Glen White Shifts To Purchased Power See p. 47

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Volume 42 No. 9

● **Faced** with the problem of speeding development in thinner coal, Hudson Coal Co. has turned to uphill shaker conveyors, duckbills, scrapers and hoes for an answer. Coal and rock are shaken up steep pitches and loaded into trips without interfering with the use of the rest of the gangway for chamber loading. The story of this phase of mechanization starts on page 53.

● **This month** Elk Horn Coal Corporation plans to run coal through its new central preparation plant now nearing completion at Wayland. Designed to handle 500 tons per hour, the plant will be one of the notable eastern Kentucky improvements of the year. And arrangements already have been made to schedule the story of this operation for publication in an early issue.

● **Almost complete** gravity flow of coal from incoming belt to loading booms is provided for in the new Streamline preparation plant of the Southwestern Illinois Coal Corporation, described on page 61. This plant, rated 600 tons per hour, also falls into the growing group washing coal up to 6 in. in size. Belts are used for all but two conveyors.

● **Mechanization** of loading necessarily involves efficient organization of auxiliary activities, even to the extent of widespread reconstruction of existing physical facilities and equipment. That Union Pacific Coal Co. thoroughly appreciates this fact is evidenced by the recently completed Reliance No. 1 modernization program, embracing both transportation and preparation. C. E. Swann gives both details and underlying philosophy in an article to appear this fall.

● **An increase** of 32 per cent in tonnage per man-shift over hand loading at a comparable mine of the same company was the three-month average recently made by the all-conveyor operation of the Turner-Elkhorn Mining Co. in eastern Kentucky. How this record was achieved, mining methods and the equipment used are detailed in the story beginning on page 66 of this issue.

● **With fall** approaching, the open season for technical society meetings begins again. This month the chemists gather at Rochester, N. Y.; early in October, the West Virginia Mining Institute holds its annual conclave; Illinois steps into the picture a few days later. As usual, Coal Age editors will be on hand to squeeze the juice of the discussions into our news pages.

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Next Month: Parallel Jig Flow vs. Counter-Flow

COAL AGE

Established 1911—McGraw-Hill Publishing Company, Inc.

DEVOTED TO THE OPERATING, TECHNICAL AND BUSINESS PROBLEMS OF THE COAL-MINING INDUSTRY

SYDNEY A. HALE, *Editor*

September, 1937

◆

"Good Luck"

IN GERMANY, the salutation among miners is *"Glückhauf"* ("good luck") — an echo from earlier days when it was believed that accidents were an act of Providence not to be prevented by care. The use of the word was considered an abracadabra to forefend accident and death. Here in this country we say "Good morning," which also suggests that the day's happenings are still solely in the lap of the gods. But at the mines of the Island Creek Coal Co., the salutation is "Be careful" —a recognition that care will result in safety and a constant reminder that foresight will prevent accidents. Not only the management but the miners are using that greeting when they meet.

It Won't Be Long

JUST a few years ago the public was asking what "air-conditioning" meant, but today the world is almost as conscious of the remedy for heat as of the heat itself. Only the other day a union formed in a Kansas City luggage factory called for air-conditioning as well as for more wages and shorter hours and a retail clerks' organization in Toledo also made conditioning air one of its stipulations.

This advance in weather making, with its greater comfort, sanitation and higher human and industrial efficiency, will spell in large letters summer activity and greater increased output for the coal producers because "keeping cool with coal" is no idle fiction. Before many years the public will be clamoring that housing standards which do not provide for air-conditioning every home in torrid and temperate zones are hopelessly inadequate. Not for long will be the public rest content in the sweltering heat of summer or be satisfied to live in unventilated rooms in winter.

Business of air-conditioning firms in a single month—March—of this year totaled more than $17,000,000. This figure exceeded the combined total for the first four months of 1936. Air-conditioning, heat and sprinkling for vegetable farms, and heat for sidewalks, street curbs, gutters and garages in winter will add greatly to coal consumption.

Self-Igniting Anthracite

STUDIES by the U. S. Bureau of Mines are being made into the spontaneous combustion of unmined anthracite. As the initial reaction temperature of coal is found to be in inverse proportion to its percentage of volatile matter, anthracite should be remarkably free from spontaneous ignition. So G. S. Scott and G. W. Jones may be justified in their declaration before the American Chemical Society that impurities in hard-coal seams may be the villains in the piece.

In certain sections of the anthracite region, minerals unusual in the coal fields are present and these may have catalytic effects that lower the initial reaction temperatures. Apparently, hot waters escaped from the earth carrying these minerals with them. A geologist some day may correlate these unusual deposits. Their tendency to self-ignition probably is not an inherent characteristic of anthracite, but may be due entirely to unusual minerals found in the hard coals of limited areas of Pennsylvania.

With heavily pitching beds and with coal

left in almost vertical breasts rising 100 feet or more or falling into such breasts when vacated and in the presence of decayed timber, pressure and movement grinding the hard coal may result in heating. Apparently the suggestions regarding the occurrence of spontaneous combustion come from areas with unusual mineralization and steep pitches and may reflect both.

Still Missing

HIGHBROWS may disdain popular enthusiasm for such mass amusements and spectacles as circuses and expositions, but the average citizen, unaffected by pose, flocks to them. Since it is the millions of the latter group who consume the bulk of the national production, market-wise industry capitalizes on their pleasures and predilections. The oil and gas interests, for example, already have contracted for major exhibits at the 1939 New York World's Fair, where visitors from near and far are expected to keep the turnstiles clicking. But coal is still missing from the official commitment list.

Yet the coal industry has a real story of progress to tell. Because the many improvements of recent years have never been effectively dramatized, the general public still looks upon coal mining as a backward, medieval industry, alluring only with the horrible fascination of the dark recesses of the underworld. Good showmanship can dispel such erroneous impressions and measurably enhance the public standing of the industry. Competition with other fuels which miss few opportunities to tell their story to prospective consumers makes such showmanship by the solid-fuel industry and its allies doubly desirable. The 1939 exposition offers a stage and an audience.

Safe Mechanization

WHAT once threatened to be a battle between the advocates of safety and the proponents of mechanization now happily has died down to an infrequent rumble. Confusion and misunderstanding engendered by heated statements have given way to agreement buttressed by accumulated factual data. The exponent of mechanization no longer denies that the introduction of the machine means the introduction of another potential hazard; the sane guardian of safety is willing to admit that the greater supervision which is an integral part of successful mechanization can furnish real protection against that hazard.

Actual records have demonstrated the fallacy of sweeping generalizations. The abstract claim that "mechanization is more dangerous" can no more be supported by present-day facts than the conflicting contention that "mechanization is safer than hand loading." Accident prevention depends not upon the character of the equipment used but upon the character of management and men, upon how convinced both groups are that safe operation is profitable operation and upon the degree of supervision and discipline employed to achieve that goal. Since mechanization demands greater supervision, however, it can also apply that greater supervision to the promotion of safety.

Cheering evidence of this was given by Jerome Watson at the annual convention of the Mine Inspectors' Institute. Despite the fact that roof falls rank high as a cause of accidents, Hanna Coal Co., working with the Pittsburgh No. 8 seam with its bad top, loaded over 3,000,000 tons of coal mechanically in the six-year period ended last December without a lost-time accident from roof falls while so loading. Wyoming, largely mechanized, it was brought out at the same meeting, had a better safety record than Colorado, where hand loading still predominates.

Threadbare Jest

"COAL is a dirty business, and the dirtiest part of all is the cleaning plant." Tossed off as a harmless commonplace, too often this sooty pleasantry is barbed with unhumorous truth. Grimy walls and coal dust ankle-deep on floors and runways somehow make the jape seem less bright. It is doubtful if such conditions contribute much either to sightliness or safety. The degree of improvement which might be effected, of course, is subject to sharp natural and economic limitations, but, now that more attention is being given to modernization of design and structure, it might be well to study how far the industry also could profitably go in increasing plant cleanliness.

MINE POWER CHANGE

+ Including Large Pump and New Hoist

Displaces 25-Cycle System

ONE of the few remaining 25-cycle coal-mine power systems of the United States became history when a generating plant of the Koppers Coal Co., Glen White, W. Va., was shut down recently in favor of purchased power. The general change, which included electrification of the fan and the purchase of a new main hoist, was the signal for going ahead with a drainage improvement consisting of a Sterling 2,000-g.p.m. 300-hp. deep-well turbine pump installed in a 450-ft. borehole tapping a worked-out and inaccessible section of the mine. This pump is the largest of its type used by a coal company.[1]

Faced with the necessity of replacing the worn-out boilers of the old plant and increasing the generating capacity, the company, after taking into consideration all factors, including the remaining life of the mine, chose purchased power as the alternative and better proposition. Eight 353-hp. water-tube boilers equipped with spreader-type stokers and three 300-kva. engine-driven 25-cycle 6,600-volt alternators constituted the old plant, which for some years had been operated at excessive overloads. The old plant furnished steam for the ventilating fan and coal hoist and electricity for all electrical equipment of the Glen White mine and for part of the Stotesbury mine, which is an adjoining operation of the same company.

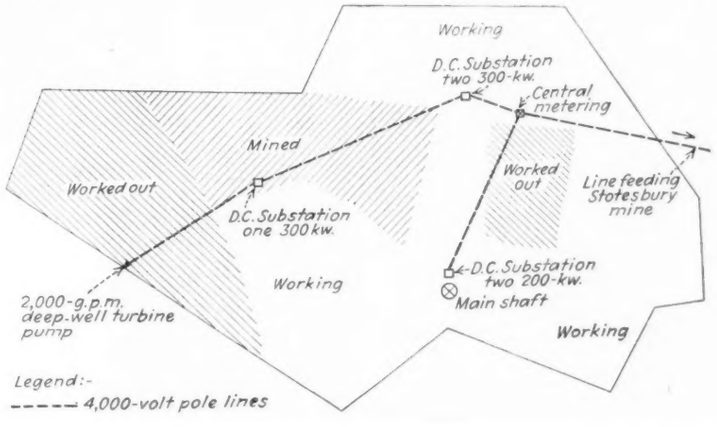
Glen White produces 2,900 tons per day from the Beckley seam, which varies in thickness from 30 in. to 8 ft. over the territory worked and has the characteristic uneven grades. Part of the mine is mechanized with scraper loaders and the preparation plant includes a Koppers-Rheolaveur washer (*Coal Age*, Vol 38, p. 337). Cover at the main shaft is 309 ft. and the terrain is mountainous. Pillars are robbed and in some instances the breaks extend to the surface and admit water.

The worked-out section at the left in Fig. 1 is a part of a dip area which within a year or two will be mined completely back to the top of a hump or divide beyond which the future work will be on a dip toward the shaft. After the mining has passed the divide the entire dip area at the left can be allowed to fill to the hump level, which is 75 ft. higher in elevation than the point in the old workings—9th left in the north section—selected for the borehole to accommodate the turbine pump; thus the ultimate duty of the pump will be to hold the water level so there will be no flow over the hump and into the active workings. To reduce the pumping head to a minimum the borehole was sunk in a deep valley; thus both surface and seam elevations entered into the selection.

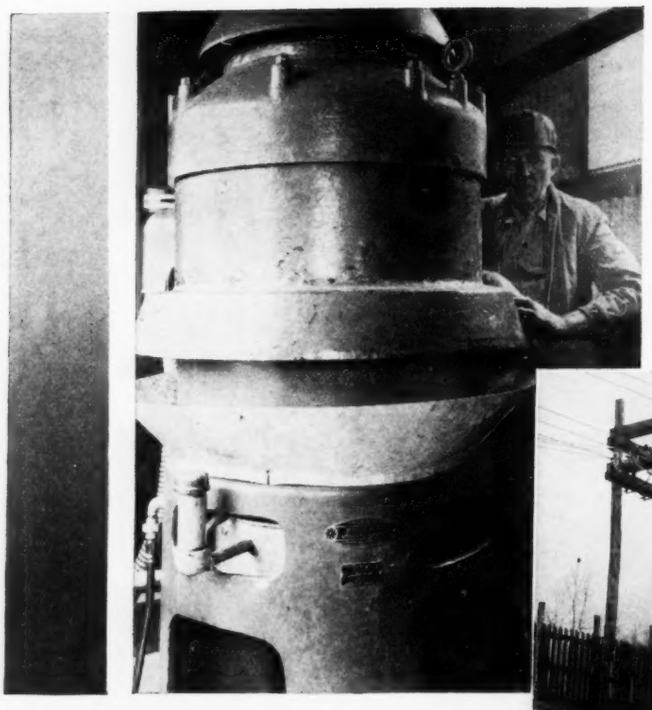
Drill-hole diameter is 18 in. and the casing consists of 16-in. standard pipe which was received in 20-ft. lengths and the joints gas-welded as installed. Engineering in locating the borehole to hit a definite point on a heading proved practically perfect. Water level stood at 34 ft. above the bottom of the coal seam when the hole was completed. The water is slightly alkaline and therefore corrosion of equipment was not a material factor in design.

Pump speed is 1,800 r.p.m., which is the upper limit of present development in units of equal capacity and head. Its casing consists of 12-in. standard pipe in 10-ft. threaded lengths. This pump is driven by a General Electric 4,000-volt 60-cycle 1,780-r.p.m. linestart induction motor rated 300 hp. continuous 40 deg. C.

Fig. 1—Glen White mine. The 2,000-g.p.m. 450-ft.-head deep-well turbine pump was installed in a worked-out and inaccessible area at the left.



[1] The State of Pennsylvania had scheduled for installation in July of this year four 4,000-g.p.m., 450-ft.-head, 600-hp. deep-well turbine pumps for dewatering an abandoned mining territory.

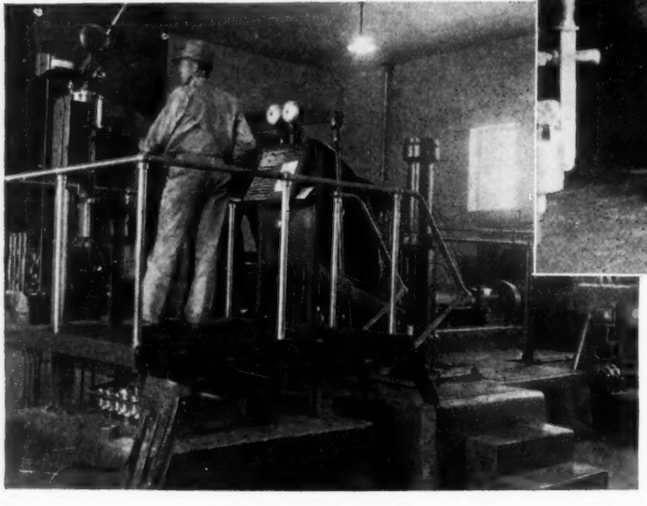


Rated 2,000 g.p.m. at 450-ft. head and driven by a 300-hp. motor, this is the largest deep-well turbine pump used by a coal-mining company in this country. T. C. Harmon, chief mine electrician, stands beside the pump.

Central metering for Glen White and Stotesbury mines. The wood structure was erected by the coal company.

A 250-hp. synchronous motor with silent chain drive displaced the direct-drive steam engine formerly used on the fan.

Two new 300-hp. motors and a duplicate pump were installed in the main bottom station.



A new hoist was purchased and its drive is a 700-hp. induction motor. Contactors are in a soundproof vault in a back room.

rise. To cool the oil lubricating a roller-type thrust bearing in the pump head a circulating system provides for carrying this oil through 75 ft. of ¾-in. copper pipe coiled in a self-draining float-switch compartment of the discharge spillway. A Viking 5-g.p.m. positive-pressure rotary motor-driven pump induces circulation.

Control equipment consists of a General Electric solenoid-operated oil-switch panel with protective relays and a T-17 timer which restarts the pump after a shutdown. This timer is adjustable to a one-hour maximum interval. During dry weather the pump is operated only over each week-end and the initial starting is effected by a man who makes a trip to the station to close the disconnects and then energize the control circuit. On a second trip to the pump, on Sunday or early Monday, the power is cut off until the next Saturday.

Four-thousand-volt power to the pump enters the building by underground conduit from a terminal pole, thus not obstructing the space in or around the permanent steel tower which was used when installing the pump and which would be used in case of a service job.

Double Station at Shaft

As a further addition to the mine pumping equipment a main station situated near the shaft was doubled in capacity when the original 25-cycle motor of the existing DeLaval 2,000-g.p.m. centrifugal unit with V-belt drive was replaced by a 60-cycle 250-hp. 4,000-volt 1,750-r.p.m. General Electric direct-connected induction motor. A second pump, which is a duplicate of the first, was purchased and its motor is the same as that placed on the other pump. Power for this station is conducted by three rubber-covered single-conductor No. 4/0 cables carried in a 3-in. conduit (standard galvanized-steel pipe) which is installed in the center of the 12-in. casing of the 295-ft. borehole serving as the discharge (*Coal Age*, Vol. 40, p. 464). Normally both of these 2,000-g.p.m. pumps are operated off-shift for six hours per day. Total main pumping capacity of the Glen White mine now is at 10,000 g.p.m.

A new electric Nordberg hoist replaces the 24x48-in. steam hoist, which had plain cylindrical drums. This new hoist has stepped cylindrical drums of 7½- and 10½-ft. diameters. The hoisting-shaft depth is 309 ft., the total lift 390 ft. and the duty consists of hoisting loaded cars (total weight of car and coal, 3.8 tons) on single-deck self-dumping cages. Lilly control provides the overspeed and overwind protection and the rope being used is a 1⅜-in. 6x19 of plow-steel grade. Geared to the hoist is a 700-hp. 4,000-volt induction motor and its magnetic control is placed in a soundproof vault built into a rear room of the hoist house.

Transmission lines accommodating the change to purchased power provide central metering of the Glen White and Stotesbury loads. At this distribution point, which is near Sophia, the Appalachian Power Co. built a step-down station and the coal company erected a distribution tower from which three 4,000-volt three-wire lines radiate to Stotesbury, to Glen White main shaft, and to two substations and the new deep-well turbine pump.

The turbine pump is situated close to the floor of a deep valley, yet the borehole is 450 ft. deep

Two sets of coal-company meters at the distribution point provide data for the power accounting for the two mines and afford a means of checking the power company's watthour meter and an approximate check on the total demand.

Reconditioned motor-generators of modern type were installed in the 275-volt d.c. substations to replace the 25-cycle rotary converters formerly used. The total d.c. capacity of 1,300 kw. is in three outside substations; one containing two 200-kw. units, another two 300-kw. units, and the third one 300-kw. unit.

Changes to the drive of the mine fan, which is the centrifugal type, consisted of removing the steam engine, pressing the crank disk off of the shaft to make way for a sprocket, installing a bearing and applying a synchronous motor with silent chain drive. This motor, made by Westinghouse and rated 250 hp., is started on reduced voltage and operates at 600 r.p.m. The chain is a Link-Belt of 8-in. width and 7½-ft. centers between pulleys.

In the tipple and preparation plant forty-three 25-cycle 440-volt motors totaling 312 connected horsepower were replaced with 60-cycle motors of the same voltage. General Electric types KT and MT were used.

Replace Employees' Motors

Since washing machines and refrigerators of employees living in company houses would have been rendered inoperative by a change of electrical frequency, the coal company at its own expense applied new motors to all of these appliances. The 6,600/110-220-volt 60-cycle distribution transformers of the lighting system were used without change on the 25-cycle power. It was necessary, of course, to install a transformer to step the 4,000-volt purchased power to 6,600 volts. Involved in the domestic service alteration was the changing of all meters to the standard frequency. Radios required no change.

A curious telephone action over the 4,000-volt transmission appeared upon installation of the new lines and power equipment. While inspecting the deep-well turbine pump a *Coal Age* editor in company with T. C. Harmon, chief mine electrician, noticed he could distinctly hear the starting and stopping of the coal hoist. He stepped out of the pump building expecting to hear the hoist still louder and was about to ask: "Are we just over the hill from the hoisting shaft?" but noticed that at a short distance from the pump building the hoist could not be heard.

Replying to the query, "Say, what have you here?" Mr. Harmon stated that the pump is one mile by air line and three miles via transmission line from the hoist. Then he pulled the disconnects of a lightning protection capacitor which is mounted inside of the pump building and no longer could the hoisting be heard. This indicated that the detection and amplification of the electrical ripples caused by the 700-hp. hoist motor took place in the capacitor.

E. C. George, formerly of the division engineering department, Mt. Hope office, is now superintendent of the Glen White mine. Transmission-line construction and installation of the principal items of electrical equipment were supervised by C. O. Gallaher, electrical engineer of the C.C.B. division, which includes the Glen White and Stotesbury mines, and of which P. C. Graney, of Mt. Hope, is division manager.

STREAMLINE MINE

+ Uses 26-Yd. Stripper and 7-Yd. Loader To Recover 6-Ft. Coal Seam

By IVAN A. GIVEN
Associate Editor, Coal Age

LIVING UP to its name, the new Streamline strip mine of the Southwestern Illinois Coal Corporation is characterized by modern equipment and methods for getting coal out of the ground and into the railroad car in the most direct line. A 26-cu. yd. stripping shovel and a 7-cu. yd. loading shovel uncover and load the coal, which is hauled to the preparation plant in 15-ton trucks with special side-opening bodies. A screening and cleaning plant with a rated capacity of 600 tons per hour includes facilities for washing all coal below 6 in. A distinguishing feature of this plant (p. 61 of this issue) is the fact that with two minor exceptions the flow of coal is uniformly downward from the head of the raw-coal shakers to the loading booms. And while the rated capacity is 600 tons per hour, the plant has handled 5,200 tons of mine-run in seven hours.

Streamline mine is located at Percy, in Randolph County, Illinois, and is served by the Missouri Pacific and Mobile & Ohio railroads. The plant was built to recover an exceptionally clean deposit of Illinois No. 6 coal averaging 6 ft. in thickness. Reserves aggregate 25,000,000 tons, and in the field being worked the characteristic No. 6 "blue band" is only about 1 in. in thickness. Thin lenses of pyrites are about the only other impurities in the coal. In several places the seam has been worked from shallow shafts in days gone by. None of these abandoned operations in Streamline territory could be called extensive, however, and to date no difficulty has been encountered in stripping over them.

Overburden thickness ranges from 25 to 55 ft., and averages 37 ft. As a rule, it is necessary to shoot about 10 ft. of hard material, although much greater thicknesses are encountered in places. Over the coal in some areas and absent in others is a black slate. Where present, this slate runs up to 6 ft. in thickness. Above it is a limestone stratum varying from 5 to 15 ft. in thickness, which comes down on the coal where the slate is absent. The limestone is overlaid in turn by 1 to 10 ft. of shale, followed by clay to the surface.

The Streamline coal acreage consists of a number of parcels of varying size separated by ravines cutting down through the bed. Operations at present are being conducted in a tract, or finger, between two such

Overburden drills generally keep at least one cut ahead of the stripping shovel at Streamline mine.

Streamline pit, with the stripper starting a new cut in the rear and the 7-cu. yd. loader in the foreground.

ravines, which is being stripped in fanwise fashion, the hinge of the fan being the present pit entrance. Stripping is done by a Marion 5560 electric shovel with 26-cu.yd. welded manganese-steel dipper, 65½-ft. dipper handle and 102½-ft. boom. As a result of the fanning method of attack, pitting in is frequent, and pit width consequently is subject to considerable variation. Normally, however, the shovel takes a 45- to 50-ft. wide cut, working from a 30-ft, coal berm, as indicated in Fig. 1. In going over old deep-mine workings, mats are used if required. Usually, however, this is not necessary, as the rooms generally are caved solid.

In preparation for stripping, the overburden is drilled with four Bucyrus-Armstrong 29-T electric well drills, making 6½-in. vertical holes, followed by blasting with L.O.X. liquid-oxygen. When the normal width is being taken and the rock is under 10 ft. thick, each cut is shot with three rows of holes. Drilling practice is based in general on keeping about one cut ahead of that on which the stripper is working. Holes are placed approximately as shown in Fig. 1. Hole spacing is dependent upon the thickness of the hard material to be shot, as follows: 7 to 10 ft. of hard material, 20-ft. hole spacing; 10 to 15 ft., 21 ft.; over 21 ft., 22- to 23-ft. hole spacing.

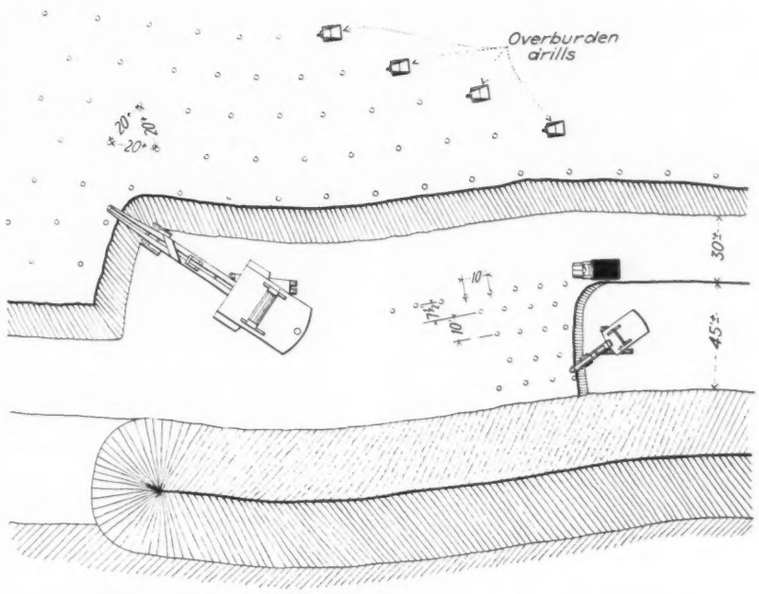
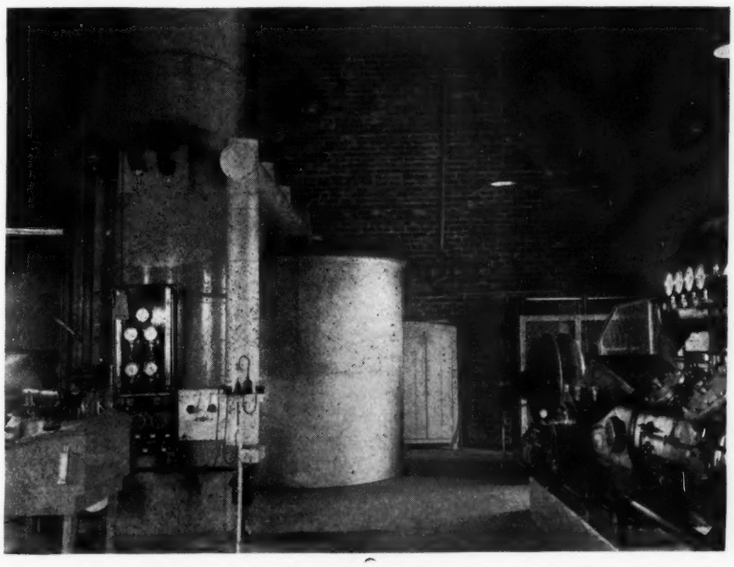


Fig. 1—Diagrammatic sketch of Streamline working plan, showing location of blast holes in both coal and overburden under average conditions.



Part of the Streamline liquid-oxygen plant, with the four-stage air compressor at the right and the liquefaction tower at the left. In the rear of the tower is the liquefied-oxygen storage tank.

Holes are staggered as between rows, and the distance between rows is adjusted so that the distance between any two holes is the same.

Liquid oxygen for shooting is manufactured in the coal company's own plant, which has a rated capacity of 80 liters (approximately 2½ lb. per liter) of oxygen with a purity of 95 per cent or more per hour. Actual output, however, is about 95 liters per hour. Lampblack in bags soaked in the oxygen constitutes the cartridges. Cartridge weight averages 14 lb., made up of 3½ lb. of bag and lampblack and 10½ lb. of liquid oxygen. If more than 1 lb. of oxygen is lost by evaporation, bringing the total weight down to less than 13 lb., such cartridges must not be used.

Hole loading is based on using one cartridge for every 2 ft. of rock where the hard material is less than 15 ft. thick. Where rock thickness is over 15 ft., one cartridge is used for every 2½ ft. as a general rule. To protect the coal, holes are stopped where possible about 18 in. above the seam, or, if the hole runs into the coal, about 18 in. of clay is placed in the bottom. General practice, however, is to have the first drill down at the start of a shift to go to the coal. With the distance thus determined, it is possible to regulate the depth of the rest of the holes drilled during the shift. Holes are shot as soon as they are drilled, on the theory that their condition never will be better and that it is possible to determine exactly the placement of the explosive. Also, as compared with shooting a group of holes at once, the time during which the oxygen can evaporate is reduced and consequently maximum results are obtained from the explosive used.

To assist the stripping shovel in making box cuts, when necessary, in heavier overburden, and also for ditching, road construction and miscellaneous work, an 8-cu.yd. Le Tourneau "Carryall" scraper powered by a Caterpillar RD-8 diesel tractor, is regularly employed at Streamline. Use of the scraper in box-cut work was described in the July *Coal Age*, p. 312, and, with some modifications, substantially the same system still is followed.

Coal is loaded at Streamline with a Marion 4121 electric shovel with 7-cu.yd. aluminum-alloy coal dipper. Cleaning in the pit consists prin-

cipally of rooting the heavy material to one side with a bulldozer, employing the same tractor used on the Le Tourneau scraper. The flexibility of the unit makes it possible to change from one job to another in less than a half hour as a rule. When old rooms are encountered, the caved material between the pillars is moved to the spoil side by the loading shovel.

The coal usually is shot before loading, but not always. When shooting is done, a Hardsocg electrically driven vertical auger making a 2-⅜-in. hole is used. Holes are loaded with pellet powder and fired electrically. Shothole spacing usually is about 10 ft. The usual hole placement is indicated diagrammatically in Fig. 1. Normally, the initial operation is to drill and fire a breaker row of several holes along the edge of the coal cut to separate the coal to be loaded from the berm.

Ten Trucks Haul Coal

Ten Mack trucks, with the special W-shaped bodies and four air-operated side opening gates developed at the Boonville (Ind.) operation of the Sunlight Coal Co., are employed to haul the coal from the pit to the dump hopper at the Streamline mine. Truck capacity is 15 tons. Because of the nature of the tract now being worked, the usual runways into the pit are not employed, and the trucks haul over the coal for the entire length of the pit, which is approximately one mile. Normally, the trucks turn on the coal in front of the loading shovel and pull ahead or back into position, depending upon which way the shovel is going. Turnouts are provided every 300 or 400 ft. for passing.

From the entrance in one end of the pit the loaded trucks run to the dump hopper on 1,300-ft. of concrete highway 13 ft. wide and 10 in. thick. Empty trucks return to the pit on a parallel road of about 18 in. of crushed rock. Concreting the loaded road has been found advantageous in that maintenance has been practically eliminated, truck movement has been speeded and wear and tear on the trucks has been reduced.

Trucks Average 4,200 Tons

Hauling the long distance over the coal that is necessary on the tract now being worked imposes somewhat more than the normal duty on the trucks. Nevertheless, over a period of a month the ten units in service average 4,200 tons of raw coal per shift of seven hours, operating over a round-trip route averaging approximately 1½ miles. Each truck averages about 50 miles per day, at 1¾ miles per gallon of gasoline. Oil consumption is close to 1 pt. per truck per shift. Trucks are serviced and maintained by two men —one full-time mechanic and one oiler, the latter spending about 80 per cent of his time on this task. When the pit is muddy, truck chassis are greased all over every other night, primarily on the theory that such lubrication will reduce the possibility of grit entrance.

Pumping equipment in the pit consists of one 2-in. Jaeger self-priming unit; two 4x4-in. American Well Works open-impeller trash pumps; two 4x4-in. Fairbanks-Morse pumps and one 6x8-in. Dayton-Dowd unit. All are of the centrifugal type and are electrically driven. Hoses are used for suction and discharge lines, except in the case of permanent or semi-permanent units, where spiral-riveted pipe is employed. All units discharge onto the surface in front of the high wall. Pumping into the spoil is forbidden because of the possibility of the water following the fireclay down into the pit and under the coal.

Power to operate the mine is purchased. Average demand is 1,250 to 1,300 kw., of which approximately 500 kw. is chargeable to the preparation plant and miscellaneous shop and office loads. Stripping and loading-shovel voltage is 4,000. All other equipment is 440 volts, with the exception of lighting circuits and certain miscellaneous small motor loads. Pit and drilling equipment is served by a ground-cable system which taps onto a 1,500-ft. pole line built from the main incoming transformer station to a point close to the pit entrance. The ground cable (Okonite, three 4/0 wires) is laid in 1,000-ft. sections, starting with a junction house at the end of the pole line. Additional junction houses are installed between each pair of 1,000-ft. sections of ground cable.

Cutouts in Junction Houses

Junction houses are built of wood on skid mountings and contain five sets of cutouts each. All cutouts are rated at 7,500 volts, and one set in each house accommodates the ground cable and connections thereto. Two additional sets provide service for the auxiliary 4,000/440-volt transformer units which reduce the voltage for the drills, both coal and overburden, and pumps. These cutouts are fused inside the houses. Four sets of pumps and drill transformers are provided, three consisting of three 15-kva. 4,000/440-volt transformers

Truck with 15 tons of coal highballing for the dump on the concrete loaded road. Paralleling it is the crushed stone empty road.

mounted on skids and the fourth of three 25-kva. transformers.

In addition to the transformer cutouts, each junction house also contains two sets of cutouts for the stripping and loading-shovel circuits, respectively. From these cutouts, short lengths of cable run to portable circuit-breaker sets, each consisting of an oil circuit breaker and a set of fused cutouts. This method of fusing the shovel circuits was adopted because of the possibility of fire in case these fuses, which necessarily must carry a heavy current, should blow in a junction house. Usual practice is to place one circuit breaker set at one house and the other set at the next house 1,000 ft. away, although both can be served from one house when necessary.

Stripping and loading shovels are served by 1,000-ft. trailing cables—Simplex with three 1/0 wires in the case of the stripper and General Electric, three No. 6 wires, in the case of the loader. Pump cables (No. 8 wires) have a length of 500 ft., and the same applies to the coal auger. One 500-ft. cable (No. 4 wires) is run out to serve the overburden drills, with 250-ft. branch cables (No. 8 wires) from the main cable to each drilling unit.

All trailing cables are equipped with Miller connectors, the plugs on the ends of the cables fitting into receptacles clamped between steel straps in the junction houses and on the circuit-breaker sets. All 4,000-volt cables (5,000-volt insulation) have a ground wire, and, to prevent the possibility of confusion in making connections, the receptacle is attached to the ground wire and the plug is mounted in the clamps, thus reversing the usual order. No reel is used on the loading shovel, and consequently connectors also are installed at the shovel in this case. All 440-volt trailing cables are insulated for 600 volts. Rubber-covered trailing cables are employed, while the ground cable is steelwire armored.

HUDSON COAL CO.

+ Speeds Development by Uphill Shakers Duckbills, Scrapers and Hoes

By R. DAWSON HALL
Engineering Editor, Coal Age

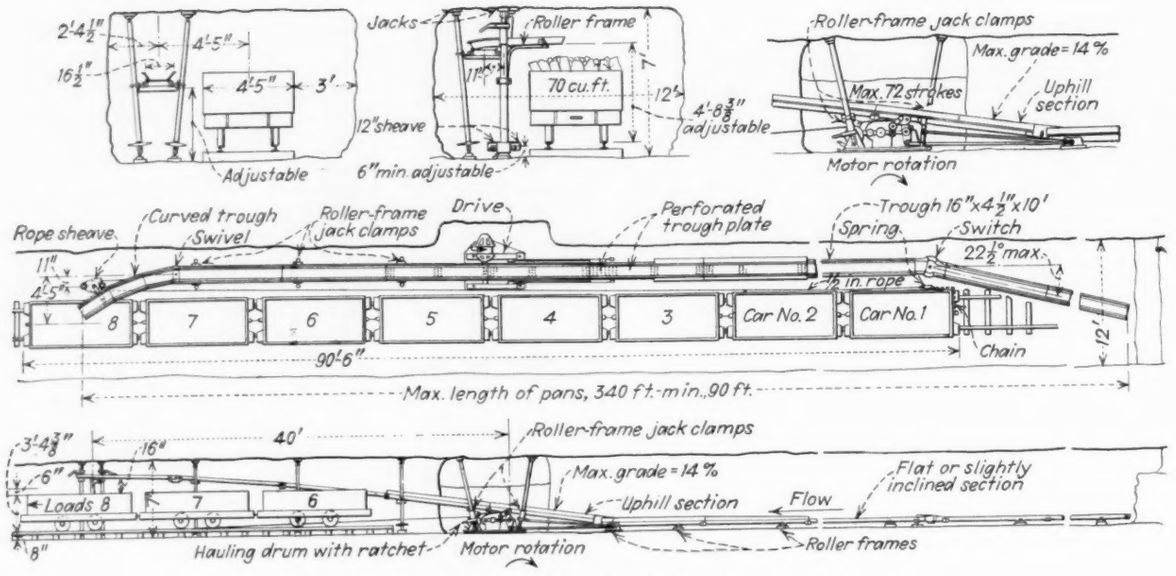
EARLY in the second decade of this century, Eli T. Conner, consulting engineer, Hudson Coal Co., asserted that anthracite production would stand still or even decline; it certainly could not increase, because operators lacked underground development and could not open new sections as fast as they had to deplete them. Later, however, it proved that anthracite tonnage was to be reduced for an entirely different reason: decreased sales due to loss of the western market during the World War, when western movement was curtailed by the U. S. Fuel Administration, and to the shrinkage of all markets as a result of oil and gas competition.

Lack of development also was compensated by the advent of new stripping methods, increased use of finer sizes and their recovery from culm banks, and by greater extraction of pillar coal. The Hudson Coal Co., however, by careful forecasting, was able to regulate its underground development to keep step with its market, actual and prospective, and thus suffered no loss from lack of development.

Nevertheless, with the mining of thinner seams it became increasingly difficult to provide sufficient development even for smaller tonnage. Sensing from its forecasting the need for more rapid gangway driving, Hudson Coal in 1933 began to introduce uphill shaking conveyors that would receive material from near the mine floor, lift and convey it so high and so far that it could be deposited into the foremost car of an empty trip, thus arranging for continuity in loading.

Such a mechanical device would not only speed development but reduce labor cost so as to meet the competition of rival fuels. It also would make it possible to drive gangways and airways without shutting down other operations in the same gangway. Cars placed along the road for loading from the several chambers could remain there; receiving their complement, while excavated material was being loaded into a full trip of cars at the end of the gangway. Thus development would be effected without such interference with production as had hitherto been experienced. Car loading by trips, always the goal of management, became possible and, with application to the work in chambers, could be made universal.

Prior to the early 1930s, it was recognized that shaker conveyors would pass coal up an inclined trough provided a proper forward impulse was given to it, followed by a sudden reversal in the direction of trough travel. Such mechanisms as had been devised, however, put undue strain on the several parts and gave such reduced capacity that the equipment was of uncertain value. Coal also, being unable to climb at capacity up the uphill section, would stop at its foot and spill over the edge of the trough. Operators and manufacturers alike recognized that the shaking conveyor, as then constructed, had its



Uphill conveyor assembly showing uphill and flat troughs and connecting rods for driving same

place only on level or downhill stretches.

Curved, inclined and even bumpered roller paths beneath the trough, sometimes with eccentric rollers, enabled material to be carried up easy gradients by raising the trough in its passage or by the jolt it received at the end of its path. But more climbing facilities were needed, especially when the material was wet or traveled less freely than coal on the trough bottom. What were required were: (1) Quick reversal in direction of the trough at the end of the forward stroke, so that the material would continue to move along the trough line after the latter began to travel backward; (2) slow motion at the end of the back stroke, so that the coal would come gently to rest and not continue to move back when the trough again moved forward, and (3) slow motion at the beginning of the forward stroke so that the coal would travel with, and not slide on, the trough.

Springs and Ellipse Gear

So, spring mechanisms which by alternate extensions and compressions afforded such conditions were provided. Elliptical gears also were introduced to convert the uniform rotary motion of the countershaft into a motion of the crank gear which delayed and thereby also increased deceleration of the forward stroke and advanced, in point of time, deceleration of the backward stroke while decreasing its intensity, thus providing those same advantages which spring mechanisms afforded. Corruguated trough bottoms that prevented backward movement of material while assuring forward movement also received application.

Carrier Legs Heave Coal

Best of all, "carrier arms," or legs, were designed that (1) on the course of each forward stroke lifted as well as carried the trough forward and held the material fast to it by a vertical acceleration that added to gravity; (2) caused the trough at the end of the stroke to rise less rapidly than the material conveyed, giving it a free trajectory extending partly over the back stroke, and (3) reduced the inclination on the end of the back stroke so much the coal could not roll back even without corrugations to hold it. These gave the trough ability to lift material and provided the inclined and enlarged sections with as much capacity as the more level or declination sections.

These lifting devices had an action similar to that of a shovel in human hands. The carrier arms could be so lengthened or shortened and so changed as to inclination as to enable the lifting sections to give equal forwarding service with the flatter sections. Applications for a patent on these carrier arms, on inclined roller sets and on longitudinal corrugations of the conveying trough were filed in Germany by Theodor Brauer, Jan. 31, 1931, and in the United States, Jan. 29, 1932, and were granted here Aug. 21, 1934.

About the same time, the Vulcan Iron Works, Wilkes-Barre, embodied in the design of its EC-1 conveyor a Westinghouse 10-hp. motor having a control which varied the speed automatically during each stroke and caused the trough accordingly to advance with a steady acceleration, 54 to 72 times per minute—preferably 66 times—and as often to travel backward with increasing retardation. The decrease in speed was provided by dynamic braking. This equipment was introduced in Hudson Coal's Grassy Island colliery in 1933.

Motor Raced and Slowed

All the trough pans were rigidly connected after the usual manner; the connecting rod of the drive was attached to the trough at the point where the inclined pan met the line of pans from the face. The motor averaged 850 r.p.m., but was driven at speeds varying from 400 to 1,150 r.p.m. in a single stroke. Thirty-two of these were installed and are still in use. The trough carries the coal along one side of the roadway to the desired point, rising with the trough as it travels over the uplift section, and delivers it to a curved section 8 ft. long with its end over the mine roadway, from which end it falls into the foremost car in the trip to be loaded. Some of these units are in gangway and some in chamber service.

To meet the severe demands of this conveying system, a d.c. motor with a relatively low inertia (wr^2) for the required rating and which would permit the frequent starts and accelerations and also take care of

the reverse current peaks during dynamic braking was required. A small-diameter long-core motor with special winding and laminated commutating poles provides electrical characteristics necessary for this service.

A controller for accelerating and dynamically braking the motors was the most difficult unit to devise. It was necessary to close the line contactor to apply power to the motor, then cut out the starting resistor in a very short time, so that the motor would accelerate to full speed; again to open these and close a dynamic braking contactor to assist in lowering the speed to about 400 r.p.m. All this had to be done in less than one second, or about 3,900 times per hour.

Restarting Device Feared

Automatic restarting might be provided in case the motor should stop on the dynamic braking part of the cycle, but this is not favored by Hudson Coal because the machine might stop and restart and catch someone unaware who believed that the drive was disconnected; hence reliance is placed upon pushbutton restarting. Overload protection had to be afforded that would both permit the high accelerating peak current and prevent the root-mean-square current from exceeding the motor's capacity.

Two units of another Vulcan uphill shaker—the E. C. special—also have been installed. The first was placed at Olyphant colliery, Heading 34, New County seam; the second is at Coal Brook. This conveyor has a 15-hp. shunt motor that makes 1,150 r.p.m. Sliding back and forth on the more level trough pan below it, the uphill trough is not, as in the EC-1, rigidly connected to it. Both divisions of the trough make the same number of strokes per minute but the length of the stroke of the uphill section is greater than that of the flatter section which leads to it. This feature adds to the lifting power of the uphill section.

The connecting rod drives the level pans back and forth through a hinge pin which also engages the end of another rod, the other end of which actuates a carrier arm to which it is attached at a point that can be varied at will somewhere between the pivoted support of that arm on the frame of the drive and its rigid point of attachment on the uphill-trough section. Another carrier arm, pivoted at a higher point on the drive, also aids in supporting the uphill section. A third arm is carried by a separate support. All arms are of the same length, have the same inclination and swing back and forth with the uphill trough section, hence the trough has an equal lift at all points in its forward travel.

The uphill section is adjusted so that the travel on it is sufficient to forward the coal or rock as fast as it is fed to the foot of the inclined section. Also, the cross-sectional area of the uphill portion is increased, so that with the decreased speed of progress in that part of the trough as much coal will be forwarded as in the flatter portion.

Corrugated Trough Bottom

In December, 1934, Hudson Coal Co. introduced an Eickhoff MSA-8 unit with carrier arms or legs like those devised by Herr Brauer. It had a 15-hp. motor, with two spring puller arms and a corrugated, or "truffled," plate welded to the upper surface of the trough bottom. Transverse corrugations have been made at intervals in this plate, so that a saw-tooth effect is produced with an inclination on the lower side and a vertical drop on the upper side.

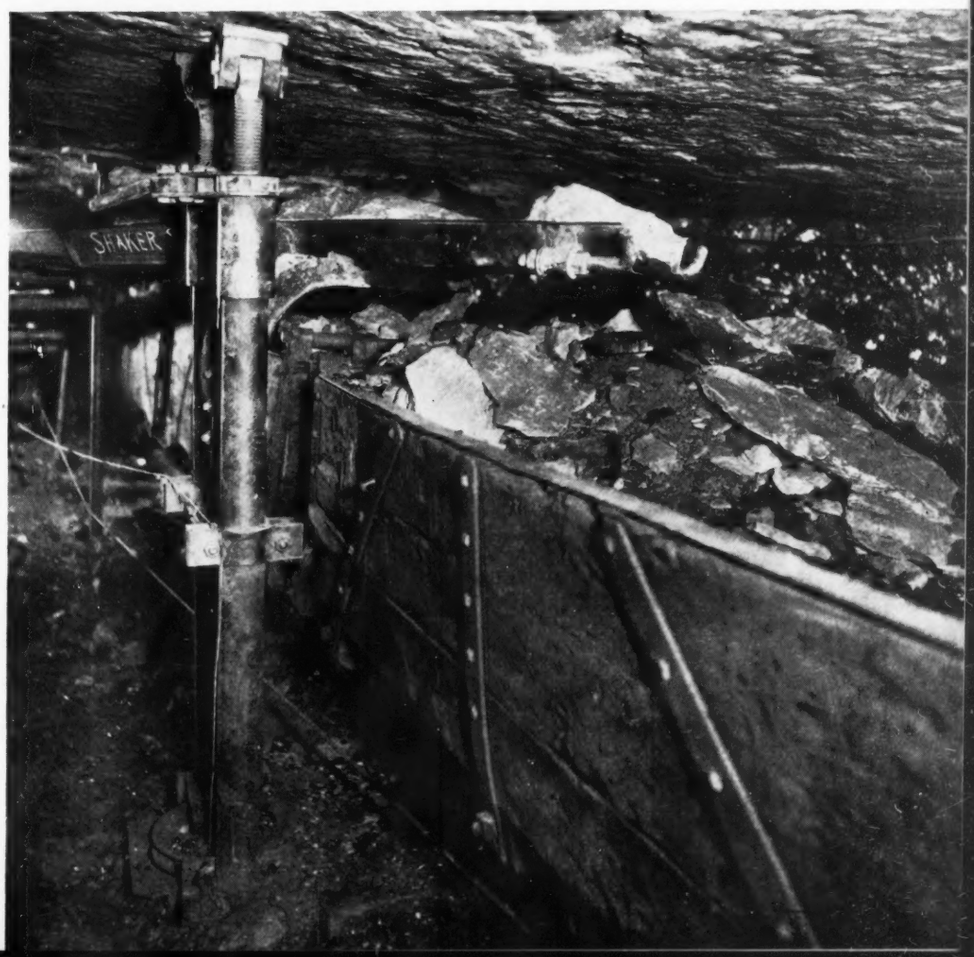
Another Eickhoff uphill shaker conveyor — the MWA — was introduced later. Carrier arms, elliptical drive and corrugated trough were all incorporated, but the spring action was omitted. The manufacturer declares that in its up-and-down section it will shake coal forward to the full capacity of the machine so long as the inclinations against the load do not exceed 6 deg. and will lift it in the main uphill section as much as 8 deg.

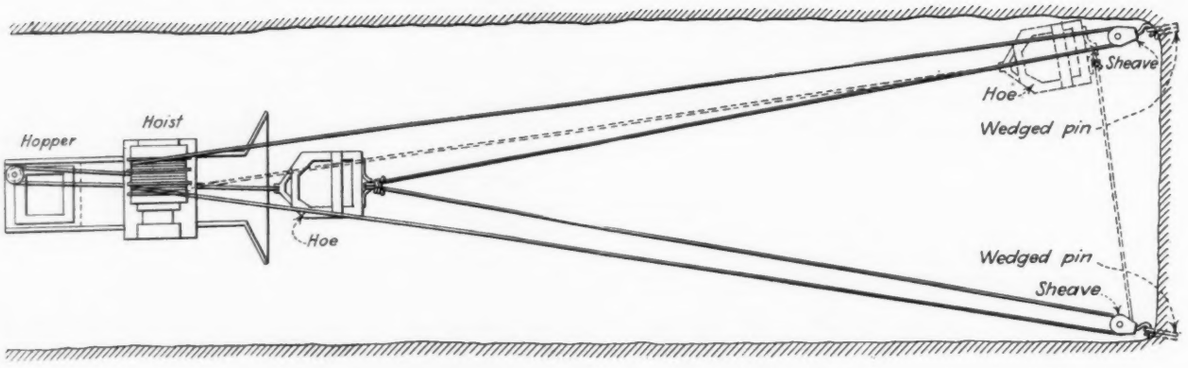
As a matter of fact, the Hudson Coal Co. (which has fifteen to eighteen of these MWAs in use, some in development and some in production) has raised coal at its Olyphant mine up a 14-deg. gradient and loaded it into cars also standing on an uphill inclination. The coal was loaded on the trough by a duckbill working on 12-deg. gradient against the load. This was in No. 20 heading, Dunmore No. 4 seam; this duckbill worked without difficulty on the smooth floor of the seam. Length of the trough was 300 to 350 ft. In the airway, another similar unit was installed with a 90-deg. swivel at the crosscut and a short length of trough through the same delivering to the trough in the gangway and thence to the mine cars.

Loaded 78 Tons per Shift

This outfit loaded approximately 22 cars per shift, or about 78 tons. The headings are 12 ft. wide; car tops are 44 in. above rail and coal thickness varies from 5 to 8 ft. Though occasional "bells," or small kettlebottoms, are found in the roof, it is a good sandstone measure, favor-

Discharging rock into mine car from uphill shaker conveyor





Hoe Scraper, operated by a three-drum hoist, advances gangway. The three drums enable rock or coal to be dragged from either rib without change or delay

able to operation. Unfortunately, the floor changes gradient frequently, but the equipment used adapts itself well to that situation.

The drive rests freely on the floor without jacks or posts to hold it down. Instead, it is attached to a connecting frame, held down by jacks, by two rods or lugs and aligns itself with this frame. Hence, the drive is kept in place without the distortion to which it might be subjected if the pressure of posts was used directly to hold it down. It can be set at any point along the trough, but is set always along its center line, so there are no transverse strains. All gearing is fully inclosed, and there are no outside moving parts. The trough is set 11.81 in. clear of the floor, which places the trough sides only 17 in. above the floor level, making it possible to use the level or more gently inclined troughs even in the thinnest of coal.

With 22 cars loaded per average day, the road need be cleared only twice daily for transportation to and from the gangway and airway faces; cars are fed to the conveyor betweenwhiles by a 5-hp. Brown-Fayro car-spotting hoist at the side of the heading. Thus, there is minimum interference with any cars that may have been parked along the roadway to receive chamber coal.

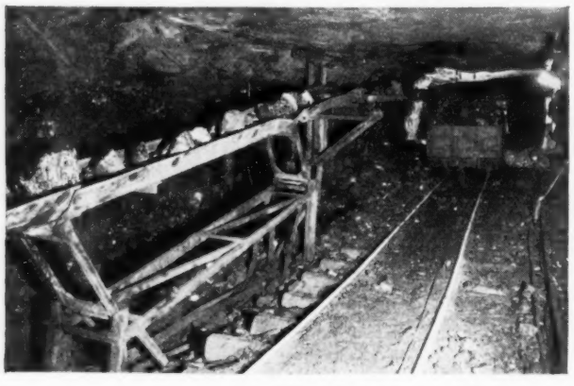
In this entry, now no longer being advanced, the uphill conveyors are being transferred to two chambers near the gangway face. For a while, one of the units will remain in the gangway; and troughs, one in each chamber, will be connected with it and driven by it through a right-angled swivel. These will deliver the coal to the main trough in that gangway by which it will be discharged into mine cars. When, however, the chambers have been extended about 50 ft., each will receive a separate unit which will deliver coal to cars parked on the gangway at the mouth of the chamber. The chambers ultimately will be 300 ft. long.

Scraper Used in Airway

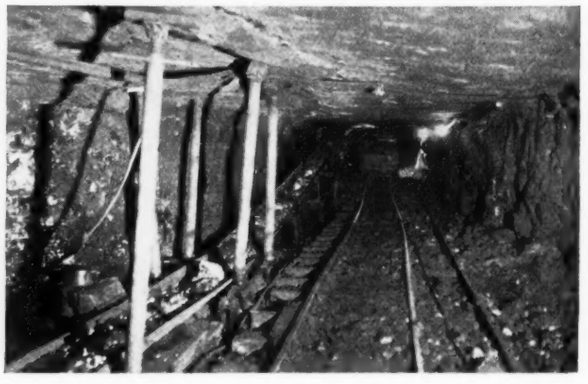
In the same workings, up a 7-per cent gradient, a tunnel leads to the Dunmore No. 3 bed above, which is 14 to 60 in. thick, but usually is between 30 and 56 in. in thickness. Here, in Heading 10 East, a Sullivan two-drum hoist, set in a crosscut near the gangway, is being used to scrape coal through a diagonal crosscut driven partly with its assistance and connecting with an airway 22 ft. wide. Formerly, such airways were driven by manual labor; made, like the gangways 12 ft. wide and of equal height; now they are being advanced by the aid of scraper and hoist. The coal is 26 in. thick, and the height of the airway will be that of the coal, which is the reason for increasing the airway width to 22 ft. A new location for the hoist will be provided every 300 ft. Pillars between gangway and airway are from 30 to 35 ft. wide.

Preparations are being made to transfer a hoe-type scraper to this heading with a three-drum 25-hp. d.c. hoist for its operation. A sheave will be attached to a wedged eye in each corner of the face of the gangway, and the hoist will drag the material with the hoe to the base of the loading slide and up its steep slope to the loading level, where the hoe will discharge its load through a hopper in the steel floor at the level to a shaking conveyor trough, which will carry it along the gangway, raise it in the lifting section and bring it over the cars by a swinging level section where it will fall into the foremost unloaded car of a trip placed for that purpose.

Coal climbing uphill via uphill shaker, Gangway 20, No. 4 Dunmore, Olyphant colliery



Another view of same. All cars but one have been removed so as to reveal shaker conveyor



A 15-hp. Eickhoff MSA-8 unit is used for transferring the hand-loaded material and will continue its service when the hoe has been installed. As rock was being lifted and the excavated bottom was rough with projecting masses of sandrock, use of the duckbill was not feasible.

In the Clark seam, from which this hoe unit is being transferred, ten or eleven cars were loaded daily by three men; similar results are anticipated in this new location, as against eight cars with manual labor and with the Eickhoff unit to handle the coal after it has been placed in the trough. It has been found desirable to advance the scraper hoist with every 60 ft. of progress. With the three-drum hoist, the operation is speedier than with a hoist having only two drums, for the rope need not be changed from one side of the roadway to the other and material can be gathered from against either rib without stopping the operation to shift the sheave.

With the hoe, one man with a floodlight operates the hoist; one man attends the loading, topping and cleaning of the coal and rock, and regulates the car advance to suit the delivery of material for loading; another one man does odd jobs, such as breaking rock too large for the machine to handle. For this entry to the face, the hoe hoist must be stopped, as the ropes whip around, while the hoist is operating. Both Ingersoll-Rand and Sullivan hoes are being used in the Hudson workings.

troughs which convey manually loaded coal and rock from the gangway, the coal in the former being 56 in. thick.

In Heading 34 of the New County seam at Olyphant, a Vulcan 15-hp. EC special uphill shaker conveyor is loading rock and coal from the end of the gangway. The coal is 34 in. thick. As the bottom is slaty and breaks along smooth laminations, a duckbill is used to load rock and coal. The airway is driven by a Sullivan scraper, the coal being delivered to the cars.

tions described are driven by 250-volt d.c. motors, but some of the Hudson's uphill-shaker units have 440-volt a.c. squirrel-cage motors. The motors have been specially designed to meet the peculiar characteristics of shaker service. For scraper work, standard industrial motors are installed, as they meet all requirements. Ordinary plow-steel rope is used for hoes and scrapers.

Attachments for feeder cables between starter and motor are Ohio Brass triple-pole connectors which can be plugged into starting box or

Extending a mine roadway by shaker conveyor trough, Gangway 20, No. 4 Dunmore seam, Olyphant colliery

Conveyor Drive Spots Cars

At the loading point of the shaking conveyor which carries the coal from the scraper unit to the cars, the latter are moved by a tugger hoist mounted on the shaker-drive frame. The hoist derives its power from the main unit. At every stroke a pawl on a ratchet wheel forming part of the gear train goes forward a notch and pulls the rope. The pawl does not go back with the backward stroke. Hence, the rope is continuously drawn along, and the cars move in the opposite direction to the rope at point of spooling. Thus the drive unit not only shakes the coal from face to cars but moves the latter so as to regulate their relation to the discharge.

In Heading 10 of the Clark seam, three or four rooms and the airway are discharging their contents into cars as gathered by scrapers all operated by a 7½-hp. d.c. motor hoist, and at the face a Vulcan EC-1 with 10-hp. motor operating at automatically controlled speeds is driving

Both the EC-1 and EC special are equipped with a haulage drum for spotting cars. In Heading 34 three men load eleven or twelve standard cars in a seven-hour shift. One advances the duckbill; one man, at the discharge of the shaker, "tops" and handles the cars, and a third man shovels what coal cannot be reached by the duckbill, which, however, has a 30-deg. swivel back of it so that it can reach practically all parts of the face.

In all installations the cars are well loaded by a man at the point of discharge. He not only "tops" the cars but cleans rock from coal and, if he is loading rock, removes coal from rock. By means of uphill shaker conveyors, speed of advance in development has been increased from 1.5 to 3 times that obtained by other methods, and the forecasting provisions have been revised to meet this new condition.

Capacities of uphill shaker conveyors vary from 25 to 45 tons per hour for coal or rock, dependent on the equipment used. All the installa-

motor by the crew that relocates the equipment. The plugs are suited for use on 440-volt a.c. or 250-volt a.c. lines and have capacities of from 1 to 50 hp. inclusive. Designed to the specifications of the Hudson Coal Co.'s engineers, these plugs can be used by non-electricians for making connections without fear of mistake, just as domestic appliances can be attached to the house lines by maids and owners.

Since these connectors do not need soldering they can be used in places where soldering might involve gas hazards. Contact is made by placing the cap on the body and rotating it, which brings it into a permanent tight contact, which is further held by a lock.

The KAD starter of which these plugs are a part, though originally designed for Hudson Coal Co. and used for hoists, compressors and like apparatus, has never been standard at its mines, because certain characteristics of shaker-conveyor service called for a further implementing of this equipment. Shaker conveyors

Gangway speeded forward by means of conveyor and scraper in Gangway 25, Top Clark seam, Olyphant colliery

involve sudden peaks, for the trough has to be raised in tenths of a second to full velocity and then decelerated in an even shorter time. They also have variable loads and distances of travel; the material handled is sometimes wet and adhesive and sometimes dry. Moreover, the equipment may be placed where it will receive either more or less than normal voltage, for there are always transmission losses. As a result, the troughs tend to run at greatly varying speeds: yet they should operate at the speed for which they were designed.

Maintenance charges vary directly as the cube of the speed, and, if the trough is driven too fast, the material shimmies back and forth and movement of coal decreases. To prevent the speed from exceeding that which is suited to maximum capacity, Hudson at first used appropriate changes in gearing. This met such variations in voltage as were due to location with relation to the substation but not variations in voltage or changes in travel or weight of material, which are less permanent and more frequent and accordingly need a more flexible means of control.

So, for complete adaptation to shaker demands, the KAD equipment needed a field-regulating rheostat for normalizing the speed under all conditions. Thus, as the result of suggestions of Hudson engineers, the KAD starters blossomed out as KAD specials and are in use at Hudson mines in the service for which they are specially designed—shaking devices.

With the variable shunt-field rheostat in the KAD special the attendant can select the proper number of strokes for best results. Oscillograms made by the coal-company engineers have enabled them to select a suitable control for these motors, which control the KAD special embodies. The company now uses also similar slightly modified General Electric control equipment, known as CR-4061-Y-1.

With thin seams like this, in Gangway 26 of Top Clark seam, Olyphant colliery, mechanization is imperative

LIGHTNING DANGERS

+ To Coal-Mine Distribution Systems Minimized by Protective Devices*

By C. T. PEARCE
and R. C. ALLEN

Engineers, Westinghouse Electric & Manufacturing Co. Philadelphia, Pa.

LIGHTNING protection and surges resulting from lightning are of increasing interest to coal operators, particularly where the mines are located in mountainous country, because the exposed electrical equipment often includes transmission lines, substations of various types, transformers, and both alternating- and direct-current rotating machinery. Lightning is the breakdown to earth of a static charge on the clouds.

For a long time it was thought that lightning disturbances were due more to the surge induced by lightning in the vicinity of the transmission system, rather than a direct stroke. As a result of research during past years, however, the reverse is now considered more probable.

Disturbances in power systems are due to three general causes:

1. Direct stroke of lightning.
2. Surge resulting from a lightning stroke either direct or in close proximity.
3. Surges due to switching large blocks of power.

The characteristics of a lightning surge, as it travels along a transmission line, is one of a steep voltage wave front of extremely high magnitude, accompanied by a corresponding current wave (Fig. 1). This all happens in micro-seconds—that is, millionths of a second—and it is this sudden thrust of voltage that is so injurious to electrical equipment. The function of lightning protection is to not only drain off the surge, so that the peak will not be so high, but also to reduce the steepness of the wave front to ease the stress in the insulation of the electrical apparatus.

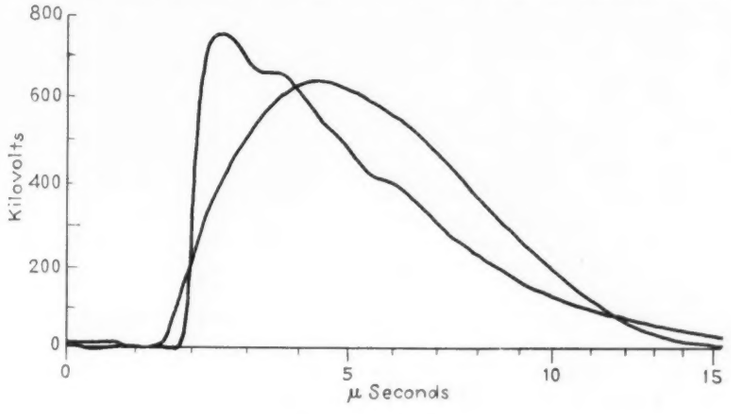
Lightning has much the characteristics of a prize fighter's punch. A direct stroke is like a "sock to the jaw" and can be a knockout unless the recipient is built to take it. The shock, however, goes through the system. With arresters installed, the stroke is like a glancing blow: part of the effect is "drained off," so that the peak is not as great, even though of the same steepness. Complete protection for equipment such as rotating machinery requires protective apparatus which will also slope the wave front so that the blow becomes more of a push, even though of the same magnitude, and against which the electrical equipment can, so to speak, brace itself.

Then, there also is the reflected wave. Under certain conditions a traveling wave meeting an obstruction is reflected so that the voltage stress at the point of reflection, or in close proximity, can be twice the otherwise normal peak. With proper protection there is no reflection of any magnitude. Surges also are caused by switching large blocks of power, such as opening a heavy loaded feeder or a fault on the system, usually accompanied with circuit interruption, but these are generally unimportant.

An arrester is used to safeguard the insulation of electrical equipment by reducing the harmful overvoltage and thus preventing it from breaking through or over the insulation to the earth. Electrical equipment generally is designed and tested for an insulation breakdown voltage considerably in excess of normal voltage, depending upon the type of the apparatus, so the arrester should limit the surge to within the insulation limits. Rotating equipment is the most vulnerable to peak surges, and generally the most difficult to replace, so should be protected most effectively. Transformers inherently can be overinsulated, while transmission lines can stand the most abuse.

The underlying principle of any lightning arrester is to discharge and dissipate the surge when the voltage

Fig. 1—Surge waves on a transmission line produced by a portable surge generator to simulate a surge following a lightning stroke. Note the steepness of the wave front. The time is in micro-seconds (0.000001 second).



* First of two articles. The second will appear in October.

across it reaches a certain value, and then cease to pass current at a lower voltage that is still above the normal operating voltage. The ratio of the peak voltage permitted by the arrester to that at which it will cut off is known as the protective ratio, and is a very important characteristic of any arrester. Obviously, the insulation of the circuit must be adequate for the normal voltage times the protective ratio, as otherwise the surge will break through the insulation, since it is the weakest point. Arresters available today have a ratio of about 2.5 to 1, but even a lower ratio is required for certain apparatus and a higher ratio is permitted for others.

After an arrester is broken down by the surge voltage, its voltage should not increase appreciably when the surge current increases. In this respect the ideal arrester should have the characteristics of a safety valve—normally closed but instantly ready to open and relieve the dangerous pressure, and equally ready to reclose when the pressure has passed.

An arrester has very little thermal capacity. It will pass thousands of amperes for a few micro-seconds, but will ultimately fail if a fraction of an ampere of current is passed through it continuously. For this reason, the rated voltage of an arrester application must always be well above the maximum circuit voltage to ground under any operating condition; otherwise the leakage current will destroy the arrester. The same is true if the arrester fails to valve off the power follow current after disrupting a surge discharge.

Arresters are designed to be adequate for passing the discharge currents with all except a few of the exceedingly severe direct strokes, and even then, while the arrester may in some cases be destroyed, the fundamental function of the arrester in protecting the major equipment is achieved. They will handle all traveling waves originating from lightning strokes out in the line or adjacent to it.

Field investigations conducted during the last few years on four high-voltage transmission lines indicate that stroke currents rarely exceed 150,000 amp., while only 20 per cent exceed 50,000 amp. Steel-tower currents are actually less, since several towers usually are involved in one stroke. Station-type arresters having a surge current discharge capacity of 50,000 to 100,000 amp. are now available. The distribution-type arrester can be obtained suitable for 30,000 to 50,000 amp.

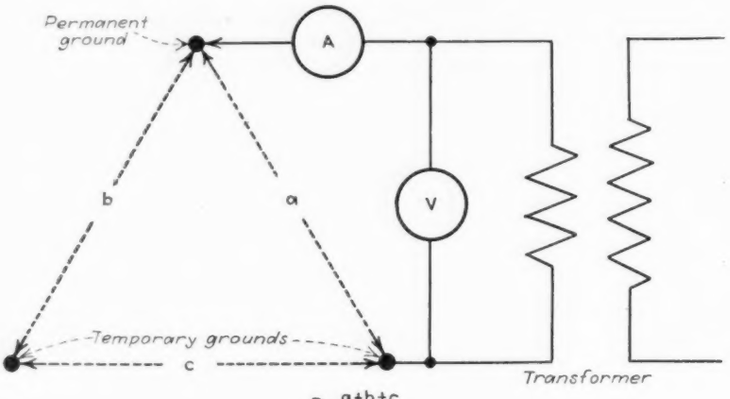


Fig. 2—Triangular method for determining the resistance of a ground connection using temporary grounds where other low value grounds, such as water pipes, etc., are not available

As a result of constant investigation and research, the arrester has progressed from the simple but inadequate multi-gap discharge unit, choke coil, and horn gap, through the expensive but elaborate electrolytic type, to the present compact and effective unit that is easy to install and requires little or no attention or replacement if properly applied.

Arresters are of various types and designs to afford adequate protection for the different types of electrical equipment from the harmful effects of surges. Each type has specific characteristics and ratings as required for the particular application for which it is designed.

The question is frequently asked as to what constitutes a good ground. The better the ground, the better the protection, so that the best ground is none too good. Lightning discharges or surges run into thousands of amperes and a high ground drop can put the arrester at such a high discharge or ground voltage that it loses much of its effectiveness as an arrester. A 5,000-amp. surge through a 30-ohm ground would produce a 150,000-volt drop in the ground only. In general, ground resistance should be kept below 30 ohms if at all possible, where best protection is desired. It is also important that the ground lead be adequate to handle the discharge current.

To obtain a good ground connection a large rod or pipe should be sunk 6 ft. or more into soil that is continuously damp. Where that type of soil is not available it may be necessary to place a brass plate in a hole as deep as feasible and attract or hold moisture by layers of coke and salt. In the station itself water pipes can frequently be used as excellent grounds.

The ohmic value of an earth ground can be obtained either by means of special instruments designed for that purpose or with ammeter and voltmeter, using two auxiliary grounds. These auxiliary grounds should be driven approximately 20 ft. apart and the resistance measured between each pair of ground connections. The readings should be nearly the same for accurate results and the voltage sufficiently high to obtain good readings (Fig. 2).

A difficult situation arises when, as is frequently the case, the logical location for the substation does not make available a satisfactory ground. An instance might be a 2,300-volt substation located on the hill above the mine, with the direct-current supply fed to the mine through a borehole some distance down the hill on the other side.

Arresters should, of course, be installed on the 2,300-volt line to protect the substation equipment as well as the line. Direct-current arresters should also be installed at each end of the exposed direct-current line. Both the 2,300-volt a.c. arresters, as well as the negative lead of the direct-current system, should be connected to the substation ground. In addition, the negative lead should also be grounded at intervals and connected solidly to the borehole casing. This arrangement is preferable to running a separate ground wire to a distant point having better grounding conditions, since the latter scheme introduces the impedance of the ground lead and thereby reduces the protection on the equipment.

GRAVITY COAL FLOW

+ Plus Washing of Minus 6-In. Coal

Distinguish Streamline Preparation

ALMOST complete gravity flow of coal from the discharge end of the incoming belt to the loading booms is a major feature in the design of the preparation plant for the new Streamline stripping operation of the Southwestern Illinois Coal Corporation, Percy, Ill. Excluding washer-refuse elevators, material is elevated from a lower to a higher level in only two minor instances. Another design feature of the plant, which has a rated capacity of 600 tons of raw coal per hour and has handled as high as 5,200 tons in seven hours, is the use of belts for all but two conveyors. All coal from 6 in. down is washed. Provision also is made for primary and secondary crushing, middlings crushing and recirculation, and mixing—both on the classifying screens and in a mixing conveyor.

Plant Cleans No. 6 Coal

The plant is designed to clean coal from the Illinois No. 6 seam, which is sold under the "Streamline" trade name by Walter Bledsoe & Co. Exceptional cleanliness characterizes the No. 6 seam in the field in which the operation is located. The usual "blue band" is reduced to about 1 in. in thickness, and the only other impurity of any consequence is thin lenses of pyrites. Installation of washing equipment makes it possible to reduce cleaning of the coal in the pit to scraping off the bulk of the material with a bulldozer. Occasionally, also, some caved material encountered in old deep-mine rooms is sent out with the raw coal, although the most is picked up and dumped to one side by the loading shovel. Uniformity of results even in the face of wide variations in the impurity content of the raw coal, and ability to clean the fine sizes impossible to hand-pick, were major factors in the adoption of mechanical-cleaning equipment.

The Streamline preparation plant was designed and built by the McNally-Pittsburg Manufacturing Corporation. Total height is somewhat greater than usual to make possible the gravity flow. Capacities of washers, screens, conveyors, etc., were predicated on a theoretical size yield of approximately the following: plus 6 in., 10 per cent; 6x3 in., 15 per cent; 3 in. x ½ mm., 72 per cent; ½ mm., 3 per cent. One washer was installed to clean the 6x3-in. fraction, with two additional larger units for the 3x0-in. size. It is seldom, however, and then only for short periods of time, that shipments represent the natural size yield, as more or less crushing either before or after cleaning usually is being done.

Provisions are made for the shipment of seven primary sizes, as follows: 6-in. lump, 6x4-in. egg, 4x2-in. small egg, 2x1¼-in. nut, 1¼x¾-in. nut, ¾x5/16-in. nut and 5/16-in. x ½-mm. carbon. Any combination of the seven primary sizes also may be made, and all coal above that size may be crushed to 1¼-in. screenings, if desired. In addition, the primary crusher may be set to eliminate entirely the 6-in. lump fraction.

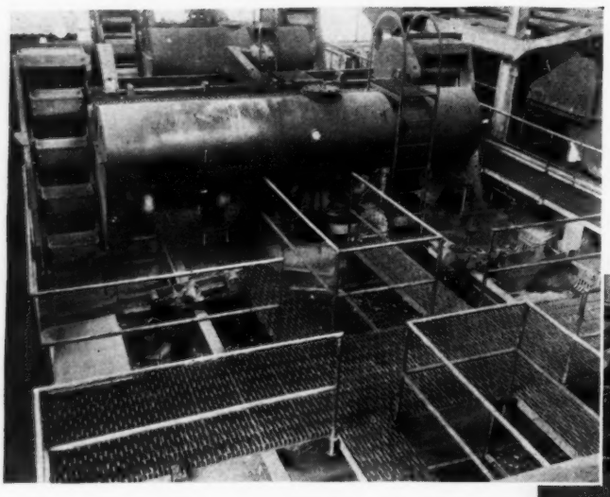
300-Ton Hopper Employed

Coal from the pit (see p. 50 of this issue) is discharged from the trucks into a 300-ton steel-and-concrete dump hopper. Provision also has been made in the design for future installation of a rotary railroad-car dumper through which the trucks also may discharge. From the dump hopper the raw coal is fed out over grizzly bars which separate it into plus and minus 6-in. fractions. Minus 6-in. coal drops onto the main raw-coal belt to the preparation plant, while the plus 6-in. coal is discharged into a McNally-Pittsburg 30x72-in. double-roll crusher with cast segments of "Ni-Hard" iron. This crusher is adjustable for breaking the feed to a top size ranging from 21 to 6 in., depending upon the setting. Coal from the crusher joins the minus 6-in. fraction on the raw-coal belt, 48 in. wide, 308 ft. long between pulley centers and inclined about 18 deg. This conveyor, in common with all other belt units in the plant, is fitted with McNally-Pittsburg "Greased-for-Life" anti-friction bearings.

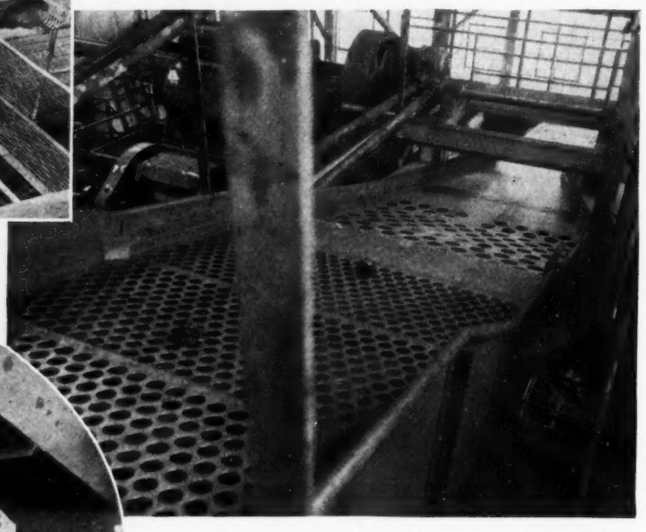
Feeding Rate Can Be Varied

The 60-in.-wide reciprocating feeder employed is equipped with a Reeves variable-speed drive unit adjustable for a feeding rate of from 150 to 750 tons per hour. The rate is controlled electrically from the operator's platform overlooking the loading-boom bay by means of a motor on the control shaft in the drive unit. To facilitate adjustment of the feeding rate, a small d.c. generator is driven off the output shaft of the variable-speed unit by means of a roller chain. This generator is connected with a voltmeter at the operator's station. The latter is calibrated in tons per hour, rather than volts, to further facilitate adjustment of feeder speed.

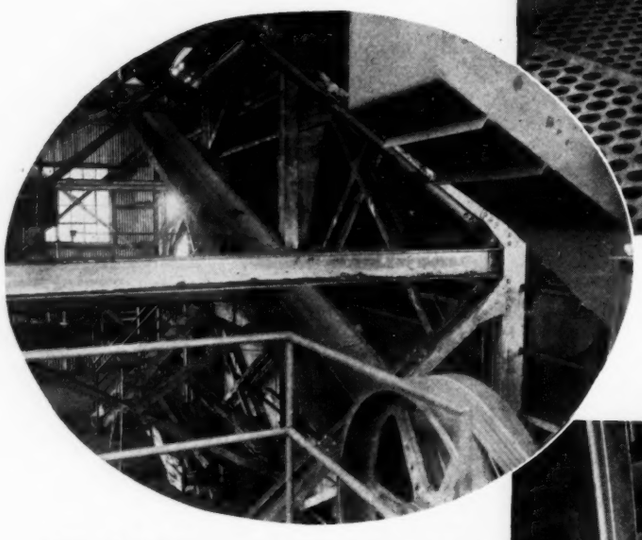
Plus 6-in. lump is separated from the raw mine-run received from the main belt and the minus 6-in. material is divided into 6x3- and 3x0-in. fractions on a pair of 8-ft.-wide steel shaker screens with bar-steel hangers and steel-pipe driving arms, oper-



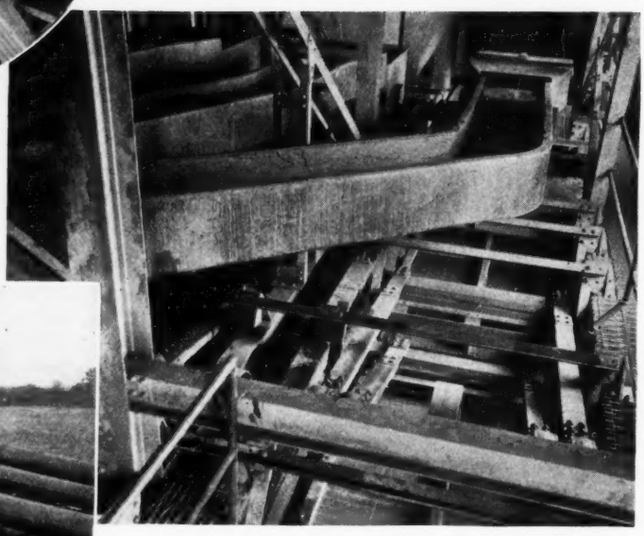
Washing floor in the Streamline preparation plant. The photo was taken from the top of one of the 3x0-in. washers and shows the other 3x0- and the 6x3-in. cleaners. At the right (not shown) are the raw-coal shakers and the 3x0-in. distributing conveyor



6-in. lump is cleaned on a shaking picking table at the lower end of the raw-coal shakers. Part of the 6x3-in. washer appears in the right background



One of the two points where material is reelevated—belt conveyor carrying crushed middlings back up to the main raw-coal belt. Washer tanks show to right of belt



Flumes and one of the three sets of high-speed shakers (½-mm. wedge wire) for dewatering minus 5/16-in. carbon

Open-air loading-boom bay with the mixing conveyor at the left

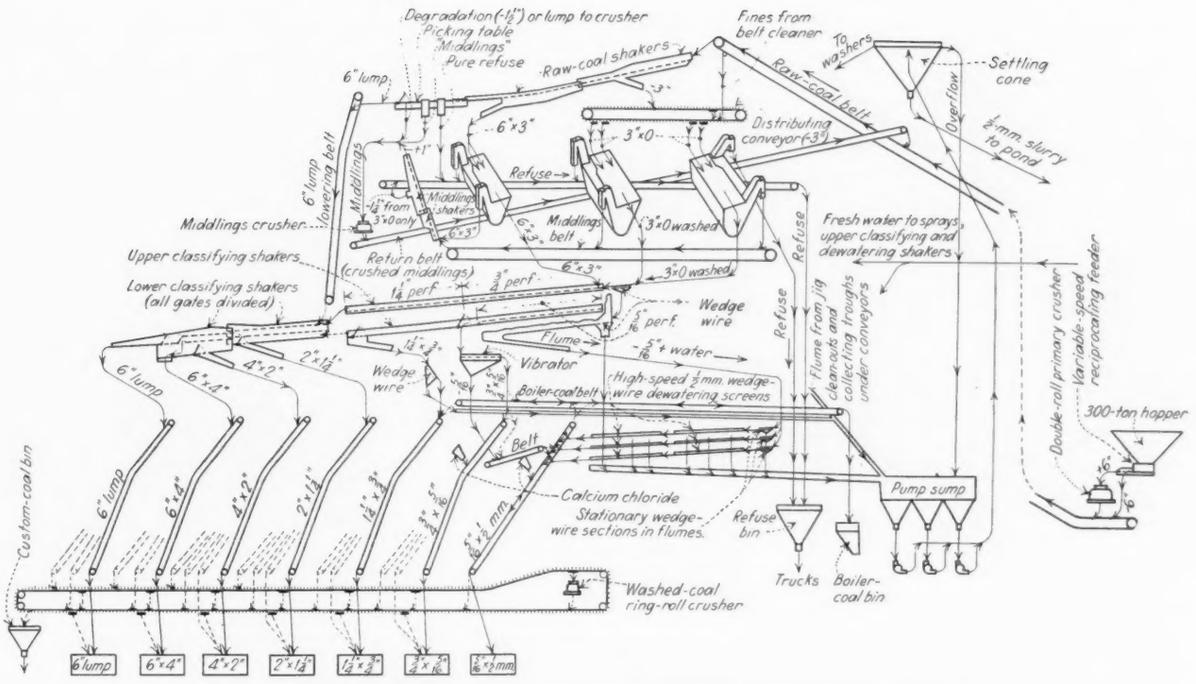


Fig. 1—All material, with two exceptions, moves downward from the raw-coal shakers to the loading booms in the Streamline preparation plant.

ating at 100 strokes per minute. The upper shaker is equipped with 12 ft. of screen plate having 3-in. round perforations, and the lower with 8 ft. of plate having 6-in. perforations. The 6-in. lump made on the lower shaker is discharged onto a 4-ft.-wide shaking picking table supported from below by 1x10-in. ash boards. Inclination of the table is approximately 7 deg.

Picking yields both pure refuse and "middlings," or material containing recoverable coal. Pure refuse goes directly to a 24-in. 51½-ft.-long refuse belt, while the "middlings" drop through a chute into a middlings crusher. A perforated gate is installed in the lower end of the table. This gate normally is closed and in that position serves primarily as a preliminary degradation screen removing minus 1¼-in. material, which goes into the chute to the middlings crusher. When opened, however, the gate permits bypassing all the 6-in. lump to the crusher for size reduction and subsequent washing. Picked lump goes onto a 30-in. lowering belt 40 ft. long between pulley centers, which discharges onto the lower classifying shaker.

Minus 3-in. coal made on the upper raw-coal shaker flows through a back chute into a 48x12-in. chain-and-flight-type distributing conveyor 22 ft. long and operating at 100 f.p.m. This conveyor, rated at 500 tons per hour, distributes the 3x0-in. material equally between the two washers installed to clean this size. Fines removed from the return run of the mine-run belt by the belt cleaner also drop into this conveyor, which is equipped with four rack-and-pinion slide gates under the lower run for adjusting the flow of coal between washers. The 6x3-in. fraction made on the lower raw-coal shaker drops directly from the discharge chute into flumes leading to a third washing unit. Two flumes, each with wash-water sprays for wetting the coal and moving it along, precede each washing unit. Air-operated steel curtains are installed in each set of flumes to permit, when desired, automatic starting and stopping of the washers in accordance with coal flow.

Three Automatic Jigs Used

Two five-cell McNally-Norton washers with automatic float controls for governing reject elimination clean the 3x0 in. coal. A third three-compartment jig washes the 6x3-in. fraction. Washing gravity in each case is 1.47. Reject from the elevators at the feed, or primary, ends of all three washers is chuted to the refuse belt, where it is combined with the pure refuse from the picking table and discharged into an approximately 1,200-cu.ft.-capacity refuse bin, from which it is trucked away.

Reject from the discharge-end, or secondary, washer elevators is classed as middlings and is routed to the middlings crusher as the first step in re-treatment. Middlings from the secondary elevators on the 3x0-in. washers are chuted to an 18-in. 60-ft.-long belt which discharges onto a pair of middlings shakers supported from below on ash boards. On these shakers, minus 1¼-in. material is screened out and falls onto the refuse belt, while the oversize discharges into the crusher. Middlings from the secondary elevator on the 6x3-in. washer also are chuted to the middlings shakers, but in this case pass down the opposite side of the shakers from the 3x0-in. middlings where the screen plate is blanked off. Consequently, none of the fines, which contain considerable recoverable coal, are taken out of the 6x3-in. middlings.

Middlings are broken down in a 30x48-in. single-roll crusher with Ni-Hard segments. Although the crusher is adjustable, the upper size limit for the crushed product usually is 1¼ in. From the crusher the middlings fall onto a 24-in.-wide 98½-ft.-long belt conveyor installed on a pitch of approximately 18 deg., which carries them back up to the main raw-coal belt for recirculation. Both the middlings recirculation and raw-coal belts are equipped with automatic brakes.

Cleaned coal from all three washers is combined at the feed end of

the upper classifying shakers, first passing over ½-mm. wedge-wire sections where part of the water and fines are unloaded to the water-clarification system. Two decks, or screens, operating opposed at 65 strokes per minute, comprise the upper classifying shakers, which are built with wooden sides to reduce weight. Length of the shakers, hung on flexible wooden arms, is about 43½ ft. Width of the upper screen, or deck, is 7 ft., and this screen is fitted with two sizes of perforated plate—20 ft. of ¾-in. round and 16 ft. of 1¼-in. round. The lower screen, or deck, 8 ft. wide, is fitted with 20 ft. of 5/16-in. round perforated plate on the upper end for making ¾x5/16-in. nut, taken off through a gate and back chute. The lower end of the lower screen is blank, receiving 1¼x ¾-in. nut from the lower end of the upper screen and discharging it through a gate and back chute to the loading boom. En route to the boom the 1¼x¾-in. nut passes over an additional ½-mm. wedge-wire dewatering sieve. Fresh-water sprays on the upper and lower screens clean off the coal and introduce make-up water.

Vibrator Removes Fines

To insure complete removal of the fines from the ¾x5/16-in. nut, this size is passed over a 4x8-ft. single-deck Symons horizontal vibrator, the rescreened nut usually going to the loading boom (Fig. 1) and the fines to an 18.-in.-wide 23-ft.-long rescreen belt leading up to the carbon-loading belt. If the washer elevators are excluded, this elevation of the minus 5/16-in. rescreenings is the only instance, aside from the crushed-middlings belt, where material is carried up from a lower to a higher level in cleaning and sizing operations.

Minus 5/16-in. washed coal through the lower shaker noted above flows with the water to a set of three high-speed dewatering shakers operating in parallel. Additional water and ½-mm. material is unloaded by wedge-wire sieves in the collecting pan (Fig. 1) and in the flumes leading to the dewatering shakers. These shakers, fitted with bronze ½-mm. wedge-wire sieves, are 5 ft. wide and 30 ft. long, with upper and lower sections operating opposed. In all, the three screens provide 450 sq.ft. of dewatering surface.

Water and fines through the sieves flow to the water-clarification plant, while the 5/16-in. x ½-mm. dewatered carbon is discharged onto the carbon loading belt. Fresh-water sprays are installed over each screen

Table I—Motor and Drive Details, Streamline Preparation Plant.

Equipment	Speed, Feet or Strokes per Minute	Motor Details* Number	Type	Horse-Power	Full-Load R.P.M.	Drive†
Reciprocating feeder	.....	1	K	15	1,750	V-belt and gear‡
Primary crusher	.....	1	KR	40	820	V-belt and gears
48-in. raw-coal belt	300	1	FTR	100	875	V-belt and gears§
Raw-coal shakers	100	1	KR	20	820	V-belt and gears
Distributing conveyor (48x12 in., 22 ft. c.c)	100	1	K	15	1,160	V-belt and gears
Lump lowering belt (30 in., 40 ft. c.c.)	80	1	K-gear	3	47	Chain
3x0 in. washer compressors	.....	2	K	40	.....	Direct
6x3-in. washer compressor	.....	1	K	60	.....	Direct
Washer elevators	.....	3	K-gear	7½	111	Gears
Refuse belt (24-in., 51½ ft. c.c.)	250	1	K-gear	3	164	Chain
Middlings belt (18-in., 60 ft. c.c.)	200	1	K-gear	5	110½	Chain
Middlings shaker	.....	1	K	5	1,165	V-belt
Middlings crusher	.....	1	K	30	1,170	V-belt
Middlings recirculating belt (24-in., 98½ ft. c.c.)	200	1	K-gear	5	120	Chain§
Upper classifying shakers	65	1	KR	20	820	V-belt
Rescreening vibrator	.....	1	K	5	1,735	V-belt
Rescreenings belt (18-in., 23 ft. c.c.)	250	1	K-gear	3	164	Chain
Boiler-coal belt (30-in., 52 ft. c.c.)	250	1	K-gear	3	164	Chain
High-speed dewatering shakers (3)	.....	1	KG	20	1,150	V-belt
Lower classifying shakers	50	1	KR	20	820	V-belt
Lump and egg booms (48-in. belt, 40 ft. c.c.)	150	2	K-gear	5	68½	Chain
Other booms (36- and 42-in. belts 40 ft. c.c.)	150	4	K-gear	5	68½	Chain
Carbon-loading belt (30-in., 55 ft. c.c.)	250	1	K-gear	3	164	Chain
Mixing conveyor (42x12-in., 125 ft. c.c.)	100	1	FTR	75	1,160	V-belt and gears
Washed-coal crusher	.....	1	KTR	50	660	V-belt
Circulating-water pumps	.....	3	KT	75	1,180	Direct
Slurry-pond pump	.....	1	.....	20	.....	Direct
Supply pump	.....	1	.....	50	1,800	Direct
Total	.....	37	.....	927½	.....	.....

* General Electric motors employed, with exception of U. S. Electrical Manufacturing Co. unit on supply pump and certain small miscellaneous units not shown in table. † Tex-rope V-belts employed as indicated. ‡ Includes Reeves variable-speed drive. § Includes automatic brake.

for polishing up the coal and aiding separation of the fine material. The carbon-loading belt is reversible for carrying the carbon back to another 30-in.-wide 52-ft.-long belt, also reversible. Operating in one direction, the latter belt carries the carbon back to the 1¼x¾-in. loading boom when making mixtures in which this size is incorporated by manipulating the gates in the lower shaker described above. Operated in the other direction, the belt carries small nut or carbon to the heating-boiler hopper.

Steel Shakers Size Coal

Final sizing of all coal above 1¼ in. is done on two steel shakers with flexible wooden hangers operating opposed at 50 strokes per minute. These shakers receive 1¼x6-in. coal from the upper classifying screens and 6-in. lump from the lump lowering belt from the picking table. The upper of the two shakers, 7 ft. wide and 20 ft. long, has two screening decks and one blank, or carrying, deck. The upper deck is fitted with 8 ft. of 6-in. round perforated plate and the lower with 12 ft. of 2-in. round. A gate and back chute permit taking off 2x1¼-in. nut to the loading boom. Width of the lower screen is 7 ft., and the length, including the lump-carrying chute on the lower end, is 52 ft. The upper deck is blank, while the second deck has 8 ft. of 3-in. plate and 4 ft. of 4-in. round-hole plate. The bottom deck is blank.

Four divided gates in the upper and lower shakers permit making any desired combination of all or 50 per cent of the four sizes produced on the lower classifying screens. These sizes are: 2x1¼-in. nut, 4x2-in. small egg, 6x4-in. egg and 6-in. lump. The four gates, indicated diagrammatically in the flowsheet (Fig. 1), make for greater flexibility in that certain sizes or mixtures of all four sizes may be loaded separately while the other 50 per cent of the coal is routed around to the secondary, or washed-coal, crusher via the lump loading boom and mixing conveyor.

Six belt-type loading booms with Wright 3-ton boom hoists are provided for loading all sizes but 5/16-in. x ½-mm. carbon, which is loaded through a chute from the slack belt, 30 in. wide and 55 ft. long. Lump and egg booms have 48-in. belts, while 36- and 42-in. belts are provided for the other sizes. Length of each boom belt is 40 ft. between pulley centers, and the operating speed is 150 f.p.m.

Booms Feed Mixing Conveyor

Booms are arranged to discharge into the mixing conveyor in raised position. This conveyor, housed in a separate structure beyond the boom ends, is a 42x12-in. unit 125 ft. long which operates at 100 f.p.m., and is the only other scraper-type conveyor installed in the plant. Rack-and-pinion-operated slide gates in both the upper and lower strands (see flowsheet, Fig. 1, for diagrammatic arrangement) permit maximum flexibility in mixing, which may be done, depending upon the mixture, partly upon the upper strand, partly upon the lower, and partly in the chute to

the railroad car. The lower strand also is arranged to carry coal to a 10-ton custom-coal bin at one end of the mixing conveyor.

An American Pulverizer 30-S ring-roll crusher is set between the strands at the opposite end of the mixing conveyor. This crusher was installed for making 1¼-in. screenings out of washed coal 1¼ in. or over in size, and has a capacity of 225 tons per hour. Coal to be broken down is brought to the crusher on the top strand of the mixing conveyor, and the crushed material falls onto the bottom strand for return to the loading point.

All water containing fine material flows to an 18,000-gal. pump sump, from which it is pumped up to a 50-ft.-diameter settling cone by three 10x10-in. McNally-Pittsburg centrifugal pumps with Ni-Hard wearing parts. In addition to water removed in the regular dewatering operations, the pump sump also receives water and fine material, from the jig clean-outs, from the collecting troughs installed under all belt conveyors in the plant carrying wet material, etc. Clarified water from the settling cone flows back to the washers by gravity, while the slurry is run to a flume providing gravity flow to a slurry pond about ¾ mile south of the plant. From the slurry pond, clean water is pumped back to the make-up water pond by a 4-in. centrifugal unit. Make-up water is pumped to the plant by an 850-g.p.m. Peerless deep-well unit, installed for possible use with a well in case it should become desirable.

37 Motors Operate Plant

Excluding boom-hoist, stoker, heater and miscellaneous motors, the Streamline preparation plant, including make-up water pumps, is operated by 37 motors totaling 927½ hp. Plant demand is approximately 500 kw. With a few exceptions, the motors were supplied by the General Electric Co., and all operate on 440 volts. Motor types and sizes and drive details are shown in Table 1. Starting switches in the plant are General Electric combination-type CR-7008 units with Type AF-1 thermal-protected hand-reset air circuit breakers. Motors are started and stopped from two-button push-button stations, each with indicating lamp, flush-mounted on a control board in the operator's booth overlooking the loading booms. All wiring, both power and light, is installed in conduit. In addition to certain special equipment, such as the Reeves unit on the feeder, Tex-rope V-belts with or without gears, and roller chains and gear-motors with chains are used for power transmission.

A total of 290 sq.ft. of skylight is provided over the raw-coal shakers, picking tables and classifying screens, and in addition the plant is equipped with 87 steel-sashed windows. A 100-hp. boiler with Detroit Junior stoker and eleven American Blower unit heaters are provided to hold the temperature in winter to near 60 deg. Double-drum double-rope McNally-Pittsburg car retarders, in which free rope is pulled back by the load rope, are installed.

Plant control is placed in the hands of a full-time technical man, who checks the impurity content of the washed coal, the sizing and the coal content of the refuse from the washers. To prevent freezing in cold weather, calcium-chloride hoppers and feeders are installed over the 5/16-in. x ½-mm. carbon belt and the ¾x5/16-in. loading boom.

The home of Streamline coal. The mixing conveyor is housed in the auxiliary structure across the tracks at the left.

◆

8.27 TONS PER MAN

+ Is Three-Months Employee Average At Turner All-Conveyor Mine

By J. H. EDWARDS
Associate Editor, Coal Age

THIRTY-TWO per cent greater tonnage per man-shift, counting all underground and tipple employees, is the performance record at the Turner No. 2 "all-conveyor" mine of the Turner Elkhorn Mining Co., Drift, Ky., compared to that at the Turner No. 1 "all-car" mine of the same company, where hand-loading under generally similar conditions prevails. Over a three-months period (March-May, 1937) production at No. 2 averaged 8.27 tons per man-shift for all underground and tipple employees exclusive of the mine superintendent and his assistant, both of whom act as foremen. This calculation included all labor involved in moving and setting up conveyors and drives.

Turner No. 2 mine is in the Big Sandy-Elkhorn district in Floyd County, on the right fork of Beaver Creek eight miles above Martin. The coal now worked is the lower, or No. 1 Elkhorn, seam, which in that locality is 42 to 50 in. thick and averages approximately 48 in., including in all cases a 6-in. rash at the top. Development since October, 1935, when the mine was opened, has encountered top conditions both adverse and favorable. For the first 1,350 ft.—that is, approximately to Third East (Fig. 4)—the main entry was beset with 6 to 30 in. of drawslate and much of the room territory on First and Second East also encountered drawslate. Over approximately 80 per cent of the territory worked inby of Third East the top is a strong sand rock and the balance has drawslate up to 10 in. in thickness. The bottom is a hard fireclay.

Indicative of the character of the coal are the following data from analyses on 2x5-in. egg samples taken at the Lakes: volatile matter, 37 per cent; fixed carbon, 55 per cent; ash, 3.92 per cent; B.t.u. 13,818; sulphur, 0.83 per cent; ash-fusion temperature, 2,779 deg. F. The coal seam lies practically level and the entrance to the mine is a drift at an elevation 60 ft. above the railroad. One thousand acres of coal comprises the lease allotted to this mine and the cover ranges up to 800 ft.

Conveyor mining on a small scale was started in February, 1935, in the No. 2 seam, which is 22 ft. above the No. 1 seam. The intention was to recover the upper seam first and then apply the same conveyor methods to the lower seam. As de-

Fig. 1—Main and lateral shakers conveying from room face and cross-cut, respectively

Fig. 2—This angle drive spells success for shaker conveyors in the Turner No. 2 mine

velopment proceeded thinner coal was encountered—36 in., including 4 in. of bone 18 in. from the top—and the nut-slack percentage rose to 65. In spite of the thin seam, the mining cost was lower than the hand-loading "all-car" No. 1 mine about two miles distant. For those reasons it was decided to abandon the upper-seam conveyor work and start a face-to-tipple conveyor mine in the lower seam. This second development at the No. 2 mine in the 42- to 50-in. Elkhorn No. 1 seam began in October, 1935.

Present equipment consists of 1,940 ft. of 30-in. belt on the main entry, 830 ft. of 24-in. belt on the First West cross entry, six shaker conveyors (normally five working in rooms and headings and one idle because of being moved), and five shortwall undercutters. Two shifts are worked and the total production is 380 to 450 tons per day.

Officials of the company state in no uncertain terms that the success of the operation hinges principally upon an angle drive developed at the mine for the shaker conveyors. Its light weight, simplicity, and ease of installation for driving lateral pans in crosscuts is the keynote to the favorable production efficiency being obtained with the shaker conveyors.

Welding Makes Angle Drive

This angle drive, illustrated in Figs. 1 and 2, consists of a simple adjustable roof jack and a bellcrank of welded construction using structural parts of weights sufficient only to stand the duty of driving the short lateral conveyors. The weakest point of the drive is the lever *A* (Fig. 2), which has adjusting holes at each end for the connecting pins. An offset to allow the bellcrank to be high enough to hold the lateral pan above the main pan line is the cause of a strain which is responsible for the levers breaking in a few instances. As yet the limited breakage is considered less objectionable than the extra structural weight necessary to eliminate the breakage for all time.

The pin *B* (Fig. 2) is used for engaging or disengaging the lateral conveyor. It can be pulled while the conveyors are in operation, but the main pan drive must be stopped before the pin can be engaged safely and without causing damage to the equipment. Adjustment of height of the discharge pan of the lateral conveyor is secured by the simple expedient of setting the jack slightly out of plumb, as indicated by Fig. 2. One man is able to handle the separate parts of this angle drive and, if necessary, can set it up alone in 30 minutes. These angle drives were built by the La-Del Conveyor & Manufacturing Co. to conform to the ideas of the mine officials. Shaker-conveyor drives are also of La-Del manufacture. Four are the small SLS-10 size and two are the larger SLS-14, which have been found to be better suited to the conditions. Both Goodman and La-Del pans are used.

All headings, rooms and crosscuts are driven 20 ft. wide; the rooms are 220 ft. deep on 50-ft. centers and the 10x30-ft. pillars are abandoned

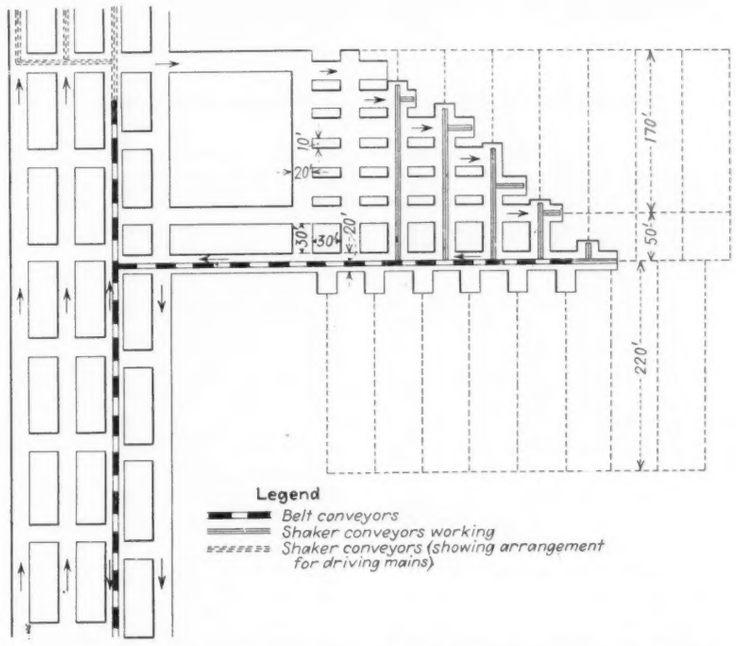


Fig. 3—Working plan showing five shaker units delivering to cross-entry belt

(Fig. 3). Room centers of 65 ft. were used in the first section, but in the later projections this was reduced to 50 ft. in order to proportion the crosscut and room advance to secure the desired cycle.

As indicated in Fig. 3, the cross entry beyond the barrier pillar is a single heading and is driven only as the room work in the panel is advanced. Air enters the panel via a crosscut in the barrier pillar, courses along the general line of the panel advance and leaves by the cross heading on which the lateral belt is installed. Safety was the principal consideration which determined that room pillars would be left in place. It was feared that the noise of the shaker conveyors would prevent hearing the warning breaks of the roof. Recovery is estimated at 80 per cent. The lease does not specify a minimum recovery, but all projections must be approved by the mineral owner. A panel is completed before the roof weight causes trouble.

The 6- to 30-in. drawslate on the main entry from the portal to First West (Fig. 4) nearly all came down with the cut. Beyond that point the entry has hit sandstone top. Because of the predominance of drawslate on the east side, the cross-entry and room equipment was transferred to the First West development, where it is now working. Here the top rash averages 6 in. Under sandstone top this rash usually stays in place for two cuts, but under slate top it comes down when the coal is shot.

Two inches of coal bottom is left below the undercut. Each mining machine remains in its pair of working places, consisting of the room face and crosscut, or the heading and a room neck. To break down the coal on a 20-ft. face four shots loaded with a total of seven sticks of $1\frac{1}{8}$-in. permissible are fired simultaneously. These charges are positioned 6 in. below the top rash; two 12 in. from the ribs and the others positioned to divide the intervening distance into three equal parts.

To mine a total of 23,499 tons of coal in the months of March, April and May, 2,106 lb. of explosive (11.2 tons of coal per pound of explosive) and 7,000 caps were used. Indicative of the timbering requirements in the mine, 2,138 posts were used

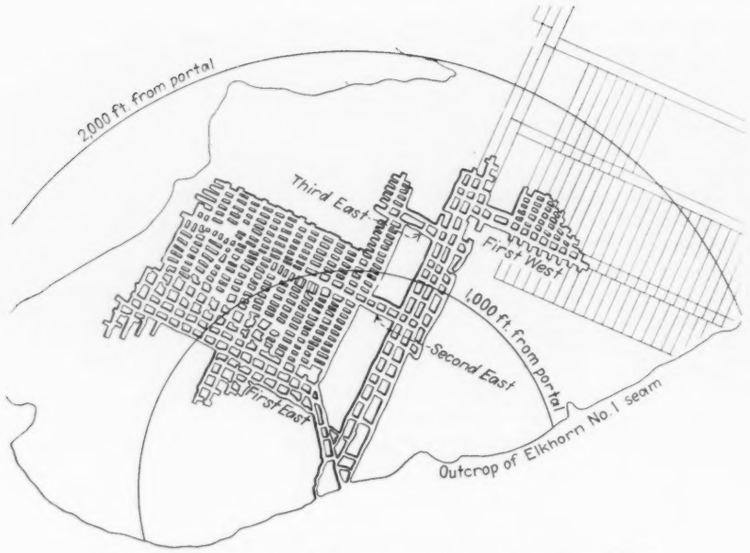


Fig. 4—Conveyor work is now concentrated in First West

during those same three months.

Twenty-one men, including the tipple help but excluding the superintendent and assistant, constitute the usual crew on each of the two shifts. Three loaders work in each of the five pairs of working places—i. e., three loaders deliver to each main pan line. Other regular inside help per shift include two cutters and two shooters. Both Jeffrey and Chicago Pneumatic electric drills are employed and the cutters also do the drilling.

Shift hours are from 6 a.m. to 1 p.m. and 1 p.m. to 8 p.m. without time out for lunch. However, the men for the most part take in dinner pails and find time to eat a bite now and then without stopping equipment or losing a significant amount of time. In order that all ten working places (five room faces and five crosscuts) shall be shot ready for loading at the beginning of the 6 a.m. shift, the cutters and shooters do not work the same hours as the loaders. The first-shift cutters and shooters (four men) begin work at 8 a.m. At 1 p.m. two more cutters and two more shooters begin a 7-hour shift, and at 3:30 p.m. two cutters and one shooter (a third shift) come to work. From 3:30 p.m. to 8 p.m., the extra shooter loads coal when not engaged at his principal duty.

During March, April and May, over which time the top rash to be handled averaged 6 in., the total man-shifts worked (including all men inside and out, except the two foremen) was 2,842 and the production was 23,499 tons—or 8.27 tons per man-shift. Turner No. 1 hand-loading all-car mine worked 2,889 man-shifts in May and produced 18,111 tons—or 6.3 tons per man-shift. In No. 1 mine the top rash is cut out and there is no drawslate or rock to handle in rooms.

In the early morning, to reduce smoke interference, loading is expedited in the cross-belt heading and nearest room neck, so that these places, whose smoke courses to no other working faces, can be cut and shot first. The several loaders concentrated there temporarily then are shifted to the room and crosscut at the fresh-air end of the panel (Fig. 3).

Shaker conveyors are positioned on the center lines of all places. The main shaker, which drives the heading for the cross belt and works parallel to that belt, discharges onto it by means of a curved tail pan, as shown in Fig. 5. Three-per-cent grade is the maximum up which wet coal can be handled with satisfaction with the shaker equipment and the conditions prevailing in Turner No. 2 mine. This requires, however, step cleats welded in the pans. Fortunately, very little wet coal is encountered.

Idler Supports Part Steel

Belt-conveyor installation was begun with used rubber belting and with used troughing idlers and return rollers. For the first 1,480 ft. of main conveyor, all-wood construction was used for supporting the idlers. Beyond that point on the main a new standard has been adopted based on part steel construction (Fig. 6). The supporting members (*A*) between pairs of 4x9-in. sawed posts consist of two 20-lb. track rails each 15 ft. long. One ½-in. bolt through the rail and post

Fig. 5—The shaker which advances the heading for the cross-entry belt is installed parallel to the belt and discharges onto it over a curved tail pan

Fig. 6—Except for side members of 20-lb. track steel and the steel idler bases, the conveyor structure is made of wood at Turner-Elkhorn No. 2 mine

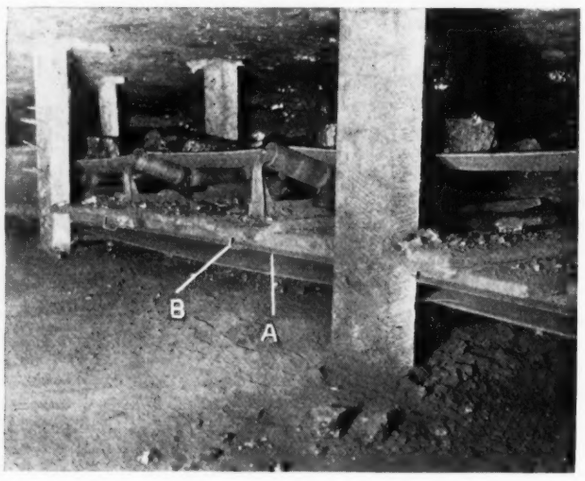


Fig. 7—Drive of the lateral or cross-entry belt. The S-type underrun drive is preferred in place of a head-pulley drive to facilitate reversing for handling men, materials and supplies

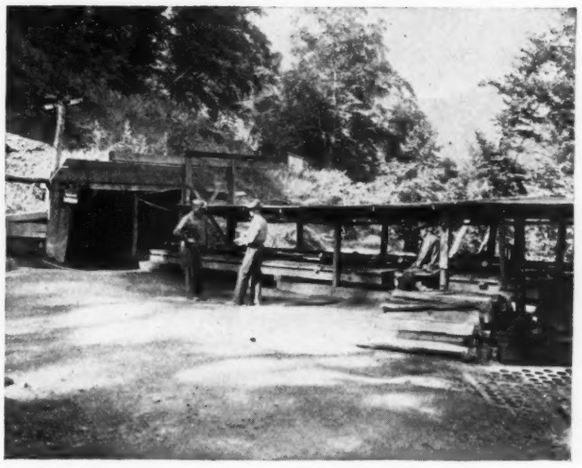


Fig. 8—The main conveyor extends 50 ft. beyond the portal to a chute to the tipple. Standing, left to right, are Ivan Reed, superintendent, and C. D. Reed, president and general manager

at each end of the rail is the attachment method.

Bottom rollers of the belt are spaced 15 ft. and their hangers are fastened also to the 4x9 posts. Troughing idlers, spaced 5 ft. apart, are supported on 1-in. oak boards placed on top of the 20-lb. rails and secured to them by L-shaped bolts (*B*). To protect the bottom run of belt from coal spillage, 1-in. boards are set, without fastenings, on the rails to fill the spaces between troughing-idler support boards. It has been determined that it does not pay to use 24-in. belt on the cross entry; future equipment, therefore, will be 30-in. belt, the same as on the main. Less spillage of coal is the principal factor, but another reason centers on minor operating difficulties that have been encountered with the narrower belt.

Now only new equipment is being purchased for belt extensions and the present standards call for Hewitt belt, 5-ply, $\frac{1}{8}$-in. top cover, $\frac{1}{32}$-in. bottom cover, and Link-Belt idlers with anti-friction bearings of the regular type which require periodic greasing.

S-Type Drives on Belts

Instead of the conventional head pulley drives, those of both the main and cross belts are two-pulley S-type drives interposed in the lower run of the belt (Fig. 7) and located at any convenient point, preferably about midway of the conveyor length. The advantages of this over the head pulley drive, as explained by the mine officials, is that the belt can be reversed for carrying men and supplies—that is, reversed without being so tight as would be required with a head pulley drive. Carrying men and supplies on the belts both in and out of the mine is regular practice.

Although the mine is a drift operation and should be free of explosive gas, closed lights—50 Model K Edison cap lamps—are used for better illumination and no time loss. It is recognized, of course, that safety also might some time enter the picture.

Tipple Has Five Tracks

An unusual feature of the mine, considering its relatively small capacity, is that the tipple has five loading tracks and that number of sizes are loaded simultaneously. The design is a simple form of board-suspended shaker and incorporates two belt-type picking tables and loading booms. The standard loading is as follows: 5-in. lump, 2x5-in. egg, $\frac{3}{8}$x1$\frac{1}{2}$-in. stoker, 1$\frac{1}{2}$x2-in. nut, and $\frac{3}{8}$-in. fines. A gravity chute 50 ft. long conducts the coal from the belt discharge at the portal to the main shaker.

Power for the mine is purchased and the 275-volt direct current which drives all motors is supplied by one 100-kw. rotary converter in a substation close to the portal. Motors, in addition to those on the mining machines (one Goodman 12AB and four Jeffrey 35B), are as follows: two 15-hp., two 10-hp. and two 7$\frac{1}{2}$-hp. units driving shaker conveyors (only 15-hp. shakers will be purchased in the future), one 10-hp. motor driving the cross belt, one 15-hp. motor driving the main belt, one 5-hp. unit on the mine fan, and one 20-hp. and one 8-hp. motors on the tipple.

Power data totaled and averaged for March, April and May, during which period 23,499 tons of coal was shipped, show a low energy requirement per ton but not a proportionally low power cost per ton; this is due to a high cost per kilowatt-hour because of small load. These data are: average of the 15-minute demand billings, 119 kw.; total energy used, 63,900 kw.-hr.; total power cost, $1,554.75; cost per kilowatt-hour, 2.44c.; kilowatt-hours per ton, 2.72; power cost per ton, 6.6c.

High Output 8.95 Tons

Efficiency and mining-cost statements are compiled for each quarter month. That for the working period May 16 to May 23 inclusive is summarized as follows: ten shifts worked, 196 tons per shift (1,961 total); 838.1 tons prepared sizes, 964.9 tons nut-slack, 158 tons r.o.m.; tons per man-shift, 8.42; total labor cost per ton, 78.2c. (made up of tipple and outside 5.8c. general 4.4c., loading and cutting, 68c. That quarter month was not the best, however; 8.95 tons per man-shift is the top-notch figure. All workmen are on day rates, which for seven hours are as follows: loaders, $6; cutters, $6.16; general, $5.36.

Officers of the company are: C. D. Reed, president and general manager, and B. F. Reed, secretary-treasurer. Ivan Reed, son of "C. D." is superintendent of the No. 2 mine, and Ward Reed, his brother, is his assistant. To Ivan Reed goes credit for developing the angle drive which is the heart of the shaker-conveyor system being used at this operation.

MINE-SUPPLY BILL

+ And Anthracite Wage Costs in 1935 Below 1929 Per-Ton Averages

By F. G. TRYON
and D. C. ASHMEAD

IN SPITE of the depression, the anthracite region of Pennsylvania remains the nation's greatest single market for mine supplies. In 1935 the region bought $27,140,346 in materials and supplies, which was as much as the soft-coal fields of West Virginia and Illinois combined. The figures relate to consumable supplies only, and do not include the value of new machinery. At the earlier census of 1929, anthracite operators reported the purchase of $5,579,000 in machinery, but no question on this point was asked in 1935.

No general census can hope to attain the accuracy of cost accounting, and so the per-ton ratios computed in Table I must be considered as approximate rather than exact. The average sales realization per net ton of all coal produced in 1935—including washery and dredge coal and colliery fuel—was $4.03, against $5.16 in 1929. The decline of $1.13 in six years speaks eloquently of the effects of the depression and of competitive conditions upon the fortunes of the anthracite industry. As the figures include strip-pit, washery and dredge coal, they are not to be taken as representing the cost of fresh-mined coal alone.

Per-ton expenditures for wages (less charges for explosives and supplies furnished to the men) declined from $3.08 in 1929 to $2.30 in 1935. During this period there was no change in the general level of wage rates, though such changes as resulted from the setting of new rates in new or reopened workings probably were downward. The chief causes for the indicated decrease in wage costs per ton during this period

Table I—Summary of All Operations Producing Pennsylvania Anthracite, As Reported by the Censuses of 1929 and 1935

(Not including illicit operations producing bootleg coal, which has been estimated at approximately 4,000,000 tons in 1935)

	1929	1935 (a) Total all Operations	1935 (a) Reported by Coal Operators	1935 (a) Reported by Strip Contractors
Production — net tons of 2,000 lb.	74,545,900	52,158,783	52,158,783	
Value of products:				Strip contract tonnage included in operators' reports
Coal, value at mine (b)	$384,754,011	$210,130,565	$210,130,565	
Average value per ton	5.16	4.03	4.03	
Other products or services	100,289	220,657	220,657	
Total value	384,854,300	210,351,222	210,351,222	
Wage earners:				
Average number, including shutdown periods	142,801	92,438	89,385	3,053
Wages paid, less charges for explosives and supplies	$229,967,059	$120,101,896	$116,364,341	$3,737,555
Cost of supplies, including explosives sold to miners	43,367,491	27,140,346	24,954,854	2,185,492
Cost of fuel	7,419,721	4,197,451	3,642,415	555,036
Cost of purchased electric power	6,508,527	7,197,413	7,088,768	108,645
Contract work	8,691,435	(a)	(a)	(a)
Per-ton expenditures for:				
Wages, less charges for explosives and supplies	3.085	2.303	2.231	.072
Supplies, including explosives sold to employees	.582	.520	.478	.042
Fuel	.100	.080	.069	.011
Purchased electric power	.087	.138	.136	.002
Contract work	.117	(a)	(a)	(a)
Ratio of expenditures to total value:				
Wages, less charges for explosives and supplies	59.8%	57.2%	55.3%	1.8%
Supplies, including explosives sold to employees	11.3%	12.9%	11.9%	1.0%
Fuel	1.9%	2.0%	1.7%	0.3%
Purchased electric power	1.7%	3.4%	3.4%	0.1%
Contract work	2.3%	(a)	(a)	(a)
Methods of production:				
Net tons mined by stripping	1,911,766	5,187,072	667,290	4,519,782
Net tons of culm-bank coal put through washeries	808,917	2,106,969	2,106,969	..
Net tons recovered by river dredges	716,944	590,467	590,467	..
Net tons undercut by machine	1,159,910	1,848,095	1,848,095	..
Net tons loaded on conveyors and other mechanical devices	3,470,158	9,279,057	9,279,057	..

(a) At previous censuses the colliery operator was asked to report payments made for contract work, but no data were obtained from contractors themselves. At the 1935 census, because of the great increase in the practice of mining coal by stripping under contract, a supplementary report was obtained from all strip contractors regarding employment, payrolls, and expenditures for supplies, fuel and power, which are summarized in the last column. These items reported by contractors are in addition to the corresponding amounts reported by the coal operators. The raw coal produced by stripping, however, is sized and cleaned in the breaker of the operator and, therefore, included in the operators' reports. As 8.7 per cent of the total production in 1935 was produced by strip contractors, it is evident that the procedure adopted for 1935 gives a more complete record of employment, payrolls and total expenditures than if the contractors were omitted. The 1935 returns, however, are in some respects not exactly comparable with those for previous censuses. No returns on the amount paid for contract work were collected from the operators in 1935.

(b) Excludes margins of separately incorporated sales companies.

This article is a byproduct of the mineral technology and output per man study made by the W.P.A. National Research Project in cooperation with the U. S. Bureau of Mines. It is published with the permission of the director of the Bureau and the director of the National Research Project.

are to be found in the deferring of development work on account of the depression, in the increasing proportion of culm-bank and strip-mined coal, and in economies in labor effected underground.

The extent of the savings in labor is indicated by the output per man per day, which increased from 2.16 tons in 1929 to 2.68 tons in 1935. Among the factors contributing to this change are the mechanization of underground loading and the rise of stripping. The tonnage mined with shaker conveyors and other mechanical loading devices underground increased from 3,470,000 tons in 1929 to 9,279,000 in 1935. The tonnage produced by stripping rose from 1,911,000 to 5,187,000.

With heavier investment in equipment, supply costs may be expected to increase, but during the years after 1929 prices of pit timber and other materials were falling. This change in material prices probably is the chief cause for the decline in computed per-ton expenditures for supplies, which were 58c. a ton in 1929 and 52c. in 1935. In relation to other items of cost, however, supplies have been increasing. Thus in 1929, payments for supplies constituted 11.3 per cent of the total value of the product and in 1935 they constituted 12.9 per cent.

At the same time, expenditures for purchased power have sharply increased. In part this is due to a shift from colliery power plants to public-utility power, but in part also it reflects an increase in the application of power underground and a very great increase in the volume of water pumped per ton of coal hoisted. The over-all result is an increase in purchased-power costs from 8.7c. a ton in 1929 to 13.8c. in 1935.

The figures in Table I include dredging operations, which produced 590,467 tons of river coal in 1935. The dredges spent $60,157 for supplies, $29,258 for fuel, $25,573 for purchased power, and $185,284 for wages. Reduced to a per-ton basis the dredging expenses were:

Supplies and materials	10.2¢
Fuel, including gasoline and oil	5.0¢
Purchased electricity	4.3¢
Wages	31.2¢

Figures for all operations other than dredges are given by fields in Table II.

It should be noted that many other items of cost besides those specified are not included in the census returns, such as the sums paid by the operator for contract work, royalties, depletion, depreciation, interest on debentures, insurance, taxes, workmen's compensation, reserves for uninsurable hazards, and other administrative and selling expense. It is, therefore, impossible to compute the total cost of production, or the margin, if any, between sales realization and cost.

Details of the data summarized in this article are given in a forthcoming report on "Employment and Related Statistics of Mines and Quarries, 1935," which is being published by the W.P.A. National Research Project on Reemployment Opportunities and Recent Changes in Industrial Techniques, in cooperation with the U. S. Bureau of Mines. The 1935 basic figures in the text and tables are taken from reports published by the Census of Business, 1935, in cooperation with the Bureau of Mines.

Table II—Production, Value of Products, and Expenditures for Supplies, Colliery Fuel, Purchased Electric Power, and Wages at Collieries and Washeries in the Pennsylvania Anthracite Industry, in 1935, by Fields

(Census of Business, 1935, in cooperation with the Bureau of Mines)

	Northern Field	Eastern Middle Field	Western Middle Field	Southern Field	Total excluding Sullivan	Sullivan County (Bernice Basin)*	Total Collieries and Washeries
Number of operations active	195	29	57	32	313	6	319
Coal produced — net ton of 2,000 lb.:							
Breaker product	27,700,235	5,248,176	10,231,664	6,091,307	49,271,382	189,965	49,461,347
Washery product (a)	524,742	.....	1,483,023	99,204	2,106,969	.....	2,106,969
Total	28,224,977	5,248,176	11,714,687	6,190,511	51,378,351	189,965	51,568,316
Value of products:							
Breaker coal	$118,945,667	$22,081,169	$40,392,762	$22,881,375	$204,300,973	$602,458	$204,903,431
Washery coal	999,258	..	3,462,744	247,828	4,709,830	.....	4,709,830
Total coal (b)	119,944,925	22,081,169	43,855,506	23,129,203	209,010,803	602,458	209,613,261
Other products or services (c)	20,392	200,265	.....	.....	220,657	.....	220,657
Total value of products	119,965,317	22,281,434	43,855,506	23,129,203	209,231,460	602,458	209,833,918
Expenditures for supplies and materials, including explosives furnished miners (d):							
By operator	13,005,795	2,632,113	5,943,124	3,237,166	24,818,198	76,499	24,894,697
By strip contractor	264,545	293,838	868,828	758,281	2,185,492	.....	2,185,492
Total supplies and materials	13,270,340	2,925,951	6,811,952	3,995,447	27,003,690	76,499	27,080,189
Expenditures for colliery fuel:							
By operator (e)	2,029,270	515,384	711,541	343,944	3,600,139	13,018	3,613,157
By strip contractor (f)	97,576	90,295	216,737	150,428	555,036	.....	555,036
Total colliery fuel	2,126,846	605,679	928,278	494,372	4,155,175	13,018	4,168,193
Expenditures for purchased electric power:							
By operator	2,202,408	812,855	2,610,968	1,432,844	7,059,075	4,120	7,063,195
By strip contractor (f)	6,024	20,613	41,768	40,240	108,645	.....	108,645
Total purchased power	2,208,432	833,468	2,652,736	1,473,084	7,167,720	4,120	7,171,840
Wages paid, less charges for explosives and supplies:							
By operator (g)	67,714,439	12,650,294	22,602,845	12,817,305	115,784,883	394,174	116,179,057
By strip contractor	449,754	945,239	1,336,304	1,006,258	3,737,555	.....	3,737,555
Total wages paid	68,164,193	13,595,533	23,939,149	13,823,563	119,522,438	394,174	119,916,612
Wage earners, average number:							
(including those paid by strip contractors):							
Including shut-down periods	53,573	11,285	18,233	8,791	91,882	362	92,244
Excluding shut-down periods	57,293	12,235	20,000	11,434	100,962	504	101,466
Net tons mined by stripping	702,299	1,347,042	1,700,973	1,418,464	5,168,778	18,294	5,187,072

(a) Includes only coal put through separate culm-bank washeries. In addition, a total of 617,350 tons of culm-bank coal was treated at breakers, 235,976 tons in the Northern Field, 143,473 tons in the Eastern Middle Field, 60,673 tons in the Western Middle Field, and 177,228 tons in the Southern Field. The total quantity of culm-bank coal treated at both washeries and breakers was: Northern Field, 760,718 tons; Eastern Middle Field, 143,473 tons; Western Middle Field, 1,521,845 tons; and Southern Field, 276,432 tons; a grand total of 2,702,468 tons.

(b) Excludes margins of separately incorporated sales companies.

(c) Includes receipts for power sold and services performed for other establishments.

(d) Includes cost of lumber or timber, iron and steel materials, explosives and oil used directly or sold to employees, water for boilers, machinery supplies and all other supplies and materials necessary to maintain and operate the mine, breaker or washery.

(e) The reported expenditures for colliery fuel in addition to the cost of coal include gasoline, diesel-engine oil and freight charges, if any, on coal used, and, therefore, exceed in some cases the f.o.b. mine value of the anthracite used for colliery fuel, as reported elsewhere by the Bureau of Mines.

(f) Coal for fuel and electric power is often furnished to the strip contractor without charge by the coal operator under the terms of the contract.

(g) The operator was instructed to "deduct charges for explosives and supplies furnished by the company."

*For statistical convenience and historical comparison, Sullivan County is included with the Pennsylvania anthracite industry, although the product is officially classified as semi-anthracite according to the American Society for Testing Materials' tentative standard.

NOTES

From Across the Sea

INDIA will cease to be India when no longer mysterious. Usually in India the roof is strong, yet breaks in the roof occur only within the vertically projected confines of the mined area, which is not the usual condition with strong roofs. Said the First Subsidence Committee of India, which studied subsidence from 1914 to 1921 and reported in 1922: "The area which can be excavated before a surface break is remarkably large," adding, however, that, where the roof is not supported by packs and where the pillars are completely removed, the area of subsidence is smaller than the area of excavation, and that, under the same conditions, where seams dip less than 1 in 5 (12 deg.), there is no draw—that is, the rock does not develop breaks outside the area of excavation.

Such breaks as are solely within the area of excavation are known as Gothic arch fractures, or Fayol domes, after the Frenchman, M. Fayol, who first described them. When mines were still shallow and the roof weak, it was the only form of break recognized in any part of the world. Later, with deeper and stronger measures, draw was noted, with fracture and, in less degree, subsidence extending beyond the vertically projected confines of excavation.

Why, then, does India in many instances have strong roof and no draw? "In no case," says the report quoted, "has the shift of subsidence been sufficient to carry the surface effect outside the position of the excavated area below. This conclusion was limited to observations of inclination [of the coal measures] less than 1 in 5." Let the advocates of the universality of Fayol fractures and domes, though their number decreases yearly, take notice! The declaration is more notable as being made by Britishers, who have had longer experience with draw than have we and therefore are more likely to be looking for it.

What is the peculiar characteristic of the Indian coal fields that makes the experience of their operators so variant from ours? Is it the presence of several feet of alluvium or the great thickness of the seams (25- and 50-ft. beds are found) or is it the existence of dikes and faults?

Appointed in 1929 by the Mining and Geological Institute of India, the Second Subsidence Committee in its recent report lays much stress on these faults and dikes and states that some of them are lubricated with water, also that the main faults are paralleled by minor faults. If these faults converge in such manner as to intersect, if extended, at some distance below the coal seam—that is, if they are as if they had resulted in geologic time from the formation of anticlinal or dome—any movement of the roof downward would bring the rock masses closer together and produce large horizontal pressures, such as support the *voussoir* stones in a flat arch and give it its great strength.

The second committee's report seems to recognize this possibility, for it says, speaking of an important collapse where there was one major and several minor faults: "It seems probable that in this case complete subsidence over the goaf was delayed by the retarding effect produced by the two faults between which that goaf was situated. These faults must have wedged the overlying rocks." As the unmined coal paralleled the fault lines and the main fault lay in the solid coal, the presence of this unmined area probably contributed to the strength of the roof.

This second report declares, however, that "the presence of faults has a considerable effect on the initiation and continuation of collapses. Since faults often intersect the beds vertically, they rob the strata in the vicinity of normal lateral support, resulting in a concentration of pressure on adjacent coal. Many large collapses have been associated with faults and particularly those, unfortunately, accompanied with loss of life."

Thus, the report suggests to the commentator that faults sometimes weaken the structure and at times give it strength; this, it would seem, would depend on whether they wedge downward or upward. Where they converge downward and give strength they may make it difficult to break the roof and thus provide for delayed collapses which, when they occur, are so sudden and so violent that they may result in air blasts that wreck the mine and kill or maim those employed in it.

The commentator might add that a wedge between two faults which approach as they proceed underground probably is under compression even before mining commences. This compression increases, and the line of pressures is not one such as would result solely from *voussoirs* trying to revolve but one of that type modified by already developed compression, which latter is not centered at the upper edge of the "middle third" but at the neutral axis. The line

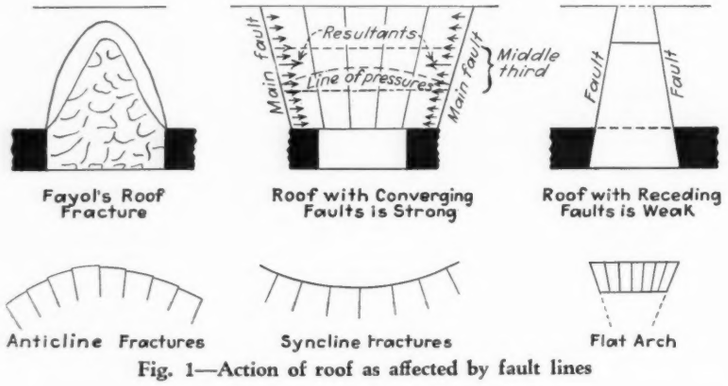


Fig. 1—Action of roof as affected by fault lines

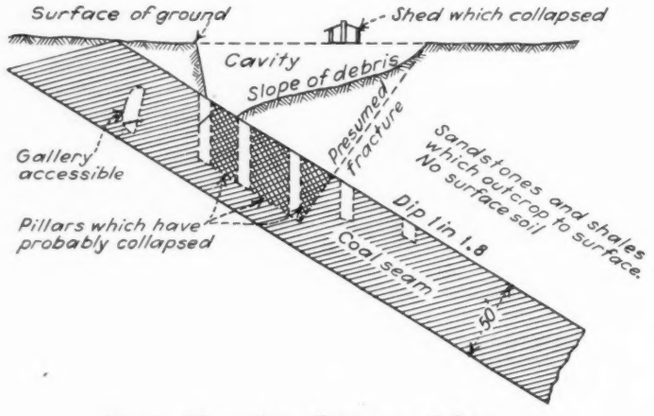


Fig. 2—Illustrating collapse in a pitching seam

of pressures, therefore, keeps well within the middle third, and accordingly there are no tensions to cause draw.

Hence, we have a roof that does not break until it pulverizes under an intensive compressive stress directed along the bedding planes. A roof thus crushed collapses immediately. When a roof fails from tension the failure is partial, for it wedges again. Hence, probably, it is not the weight of an incoherent alluvium overburden, nor the weakness of seams running 25, 28 and 50 ft. thick but the occurrence of faults that makes for India's strong roofs, sudden collapses and air blasts.

However, draw sometimes occurs when the roof collapses, as the recent report quoted shows. In fact, the report of the second committee says positive draw quite often accompanies collapses, and illustrates a collapse in a bed dipping 1 in 1.8 where the fracture probably was at right angles to the seam on the downward end of the collapse and therefore extended considerably beyond the line of vertical projection. Here only the point of collapse at the surface was known and the point of extension of the workings. The collapse was supposed to extend to the edge of extensive mining and the line of draw to follow from this point to the point of surface collapse, which would make the line of draw rectangular to the line of dip and outside the lines of vertical projection (see Fig. 2).

R. Dawson Hall

On the ENGINEER'S BOOK SHELF

Requests for U. S. Bureau of Mines publications should be sent to Superintendent of Documents, Government Printing Office, Washington, D. C., accompanied by cash or money order; stamps and personal checks not accepted. Where no price is appended in the notice of a publication of the U. S. Bureau of Mines, application should be directed to that Bureau. Orders for other books and pamphlets reviewed in this department should be addressed to the individual publishers, as shown, whose name and address in each case is in the review notice.

Review of Literature on Effects of Breathing Dust With Special Reference to Silicosis. Part III-B—Economic and Legal Aspects of Dust Disease in Industry, by D. Harrington and Sara J. Davenport. U. S. Bureau of Mines. I. C. 6892; 67 pp., 8x10½ in.; mimeograph; paper.

In only three States, three territories and the District of Columbia was compensation provided for occupational diseases prior to 1934. Four of these—Minnesota, New Jersey, Ohio and Puerto Rico—had scheduled "such occupational diseases as shall be considered compensable," but had not listed silicosis. In the remaining, six States, two territories and the District of Columbia, the compensation laws brought occupational diseases under a general coverage and through interpretation of the words "personal injuries arising out of the employment" unqualified by any requirement that such injury "shall be by accident." Under this type of law, silicosis might be considered compensable in California, District of Columbia, Hawaii, Massachusetts, Missouri, North Dakota, Philippine Islands and Wisconsin.

In 1932 the Illinois Supreme Court ruled silicosis compensable under the State workmen's compensation act, and Kentucky in 1934 permitted employers and employees engaged in certain industries to subject themselves voluntarily to silicosis compensation provisions. West Virginia amended its workmen's compensation act so as to include silicosis after March, 1935; North Carolina followed March 26, 1935, and New York, Sept. 1, 1935. This circular reviews the economic and legal aspects of industrial dust diseases and concludes with a summary of the material printed in this and previously published parts of the review.

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Dust Prevention Treatment of Solid Fuels, by L. D. Schmidt, U. S. Bureau of Mines. I. C. 6932, 10 pp., mimeograph.

Dustproofing should be (1) effective for the time desired; (2) inexpensive per ton of fuel effectively treated; (3) harmless to person, clothing or equipment; (4) odorless in consumer's bin; (5) free on firing from flashbacks or rapid evolution of obnoxious gases; (6) not liable to freeze in spraying equipment; (7) unlikely to increase tendency of fuels to cake in freezing weather; (8) not restrictive of the combustion effectiveness of the fuel or of the fusion point of the ash, and (9) not injurious to the storing qualities of the coal.

The following substances have been offered for commercial treatment of solid fuels: (1) water, (2) solutions of hygroscopic salts such as calcium chloride, (3) waste liquor from woodpulp plants, (4) solutions of blackstrap molasses, (5) water-soluble sulphonic compounds from petroleum, (6) oil-in-water emulsions, (7) oils, (8) paraffin wax, and (9) byproducts of the glycerin industry.

This interesting report is based on the literature and not on research. It discusses measurement of dustiness, general principles of dustproofing, substances used, and packaged fuel. Some questions are not raised, such as fire hazards and damage to refractories, and many that are broached are not answered for lack of evidence, such as effect on weathering or on spontaneous combustion.

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Geological Map of Kansas, by State Geological Survey of Kansas, University of Kansas, Lawrence, Kan. Price, 40x51 in., $1; mounted wall map, $2; dissected, 4x9 in., $3; 8x10 in., $2.50.

This map shows 92 outcropping geological measures with colors, patterns and lines, also drainage, towns and township lines. Scale is 1:500,000 (about 8 miles to the inch). Maps are available with or without State and Federal highways. The State contains Mississippian, Pennsylvanian, Permian, Triassic (?), Cretaceous, Tertiary and Quaternary deposits.

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Geology and Mineral Resources of the Butler and Zelienople Quadrangles, Pennsylvania, by G. B. Richardson. U. S. Geological Survey. Bulletin 873, 93 pp., 4 maps; paper. Price, 45c.

Zelienople and Butler lie in the midwestern part of Pennsylvania not far from the Ohio State line. Here the waves of the Appalachian uplift have been almost stilled, their crests and hollows far apart. True, in the southeastern corner of the Butler quadrangle are the Kellersburg anticline and the Bradys Bend syncline. At a considerable distance is the Millerstown anticline, and then far over near the northeastern corner of the Zelienople quadrangle is the Homewood anticline. A syncline lies between these crests, but it is so gentle that it has not been possible to plot it or thought necessary to name it. Dips in this innominate syncline run less than 10 ft. to the mile.

As the anticlines plunge to the southwest there are neither Permian nor Monongahela coal measures in these quadrangles. The Pottsville has, as far as is known, two Mercer beds less than 14 in. thick; the Allegheny, or Lower Productive, measures contain Brookville, Clarion, Scrubgrass, three Kittanning and two Freeport beds, and in the Conemaugh, or Non-Productive, formation is the Brush Creek bed. "The principal coal beds are the Middle Kittanning and Upper Freeport . . . which, though variable and in places absent, over considerable areas range between 30 and 40 in. in thickness and locally are thicker."

It is to be regretted that no effort has been made to determine the area of strippable coal, which might be large, because the subsurface gradients are easy and surface gradients not excessively steep.

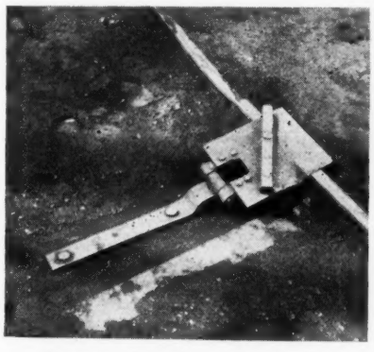
OPERATING IDEAS

From Production, Electrical and Mechanical Men

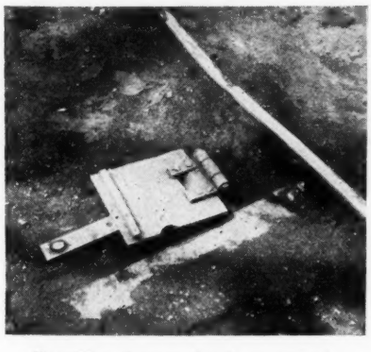
Easy and Positive Operation Features Safety Derailer

Positive action features the safety derailer shown in the accompanying illustrations, which was designed by George Rollo, top boss, Old Ben No. 14 mine, Old Ben Coal Corporation, Buckner, Ill., so that it would always be available for service and also that placing it on or removing it from the rail would require only a flip of the wrist. The derailer may be spiked to a wood tie, as shown in the illustrations, or bolted or clamped to a steel tie, so that it always is in position for use. To place the derailer in use it is merely flipped over on the rail. Flipping it the opposite direction takes it out of service so that cars may pass in the opposite direction.

Derailing is done by a 1¼-in. square bar riveted at an angle across the top of a ⅜-in. plate. To enable the car wheel to climb up on the plate more easily, the edge is beveled off and the notch for the wheel flange is formed as shown. To prevent the derailer from being slid off to the inside of the rail by the impact of the car, a ¾-in. square bar is riveted to the bottom as indicated. This bar rests against the outside of the ball of the rail when the derailer is in operating position. A bolt passing through eyes on suitable lengths of strap iron forms the hinge between the derailer proper and the strap which holds it to the tie. Scrap material is employed in the construction of the derailer, which involves about one hour of labor.



Derailer in operating position on the rail



Derailer thrown back to permit cars to pass

Battery "Motor" Best Suited To Supply Yard Service

Modernization of equipment for handling material and supplies often is allowed to lag far behind modernization of the primary mining functions, but not so at Mine No. 3 of the Koppers Coal Co., Powellton, W. Va. Special equipment in the timber and supply yard located on the floor of the valley at the foot of the man and supply incline includes a battery locomotive and a monorail crane with chain block hoist.

The locomotive (see accompanying illustration) was taken out of gathering service and later was fitted with a cab for the operator. When not in use, this locomotive is stabled in a small building in which a charging panel is mounted. The Edison battery with which the unit is equipped is well suited to this type of service, where time rather than number of charging cycles is likely to be the limiting factor in useful life.

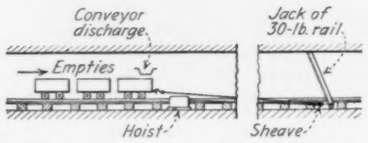
Absence of trolley wire and its supporting posts is an advantage in the material yard. Neatness, greater side clearance and no danger from electric shock are among the desirable features.

Parked in front of its stable is the battery locomotive rebuilt for use in the supply yard

Jack and Sheave Facilitate Car Movement

In conveyor mining, declares James Thompson, mine foreman, Reid Coal Co., Inc., New Bethlehem, Pa., "we have found it best to move cars past the loading point with electric hoists. To reduce the time required in changing sheaves from one set-up to another, we take a piece of discarded 30-lb. rail and bend and point the ends as if to make a machine jack. Instead, however, we attach a snatch block near the bottom of the jack by means of a large bolt. This enables us to put on or take off the hoist rope at will.

"The hoist is set within reach of the man who controls the conveyor and the



Showing how jack and sheave are used

loading of the cars on the entry. The hoist rope then is taken inby or outby the empty trip, as the case may be, placed around the sheave noted above and then fastened to the trip of cars to be loaded. No spikes or ties are required to fasten the sheave. It is complete in itself. The jack with sheave simply is held in a leaning position from bottom to top while the hoist operator undertakes to move the trip, whereupon the jack is tightened automatically. When the conveyor is moved from one room to another, little or no time is lost in placing the assembled jack and sheave in position."

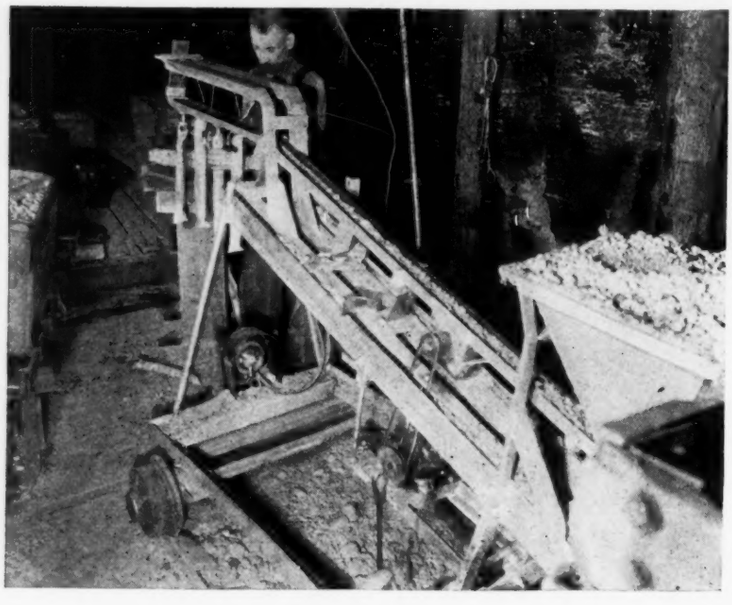
Dummy-Filling Machine Works by Vibration

Manufacture of tamping dummies at the Valier mine of the Valier Coal Co., Valier, Ill., has been speeded up by the use of a new dummy-filling machine employing the vibratory principle of conveying the filling material from the feed hopper and compacting it in the dummy bags. As can be seen in the accompanying illustration, the machine consists of a hopper, a conveyor mechanically vibrated by a small electric motor and four filling spouts with clips to hold the bags in place while they are filled and compacted. The four filling spouts connect into the horizontal run of the conveyor. The machine is mounted on wheels to permit moving it to any convenient point in the mine. At present, however, it is located in an opening on the shaft bottom.

Permissible powder with a diameter of 1⅜ in. is used at Valier. Cutting heads on the augers are set to drill a 2¾-in. shothole. In producing 7,500 tons of coal per shift of seven hours, from 800 to 1,000 shots must be fired, requiring 2,500 to 3,000 dummies for tamping. Using the dummy-filling machine, the first commercial unit installed by the Tamping Bag Co., two men, one putting on empty bags and the other taking them off after they are filled, manufacture the necessary dummies for a day's output in one shift. Under the former hand-filling system, five or six men were hard put to keep up with the call for dummies.

Dummy size is 1¾x18 in. The preferred filling material at Valier is soil just under the grass roots, although sand, clay and similar materials can be used if desired. The filling material is dug up with a clamshell, which loads it into mine cars for transportation to the dummy machine via the supply shaft. Where large lumps of material are encountered, they are broken up by hand as the hopper on the filling machine is loaded.

Dummy-filling machine in operation at Valier. Bags are held on the filling spouts by clips. On the day the photograph was taken, the second crew member was off



Undercurrent Relays Protect Centrifugal Pumps

"Numerous pumps in coal-mining service may be termed semi-automatic in that they are started at certain intervals and left unattended until shut down by a float switch in the sump. While such a.c. motor-driven pumps may not be large enough or important enough to warrant full automatic equipment, it is possible to protect them from common sources of failure by means of an undercurrent relay in conjunction with the motor starter," points out T. M. Googin, industrial division, Westinghouse Electric & Manufacturing Co., Johnstown, Pa.

"The motor-starting equipment will protect the motor from any serious overload or low-voltage condition. However, the motor starter cannot protect against low water in the sump or blocking of the intake, either partially or wholly. While the float switch is supposed to shut down the pump when the sump is empty, it is always desirable to have dual protection on such an important feature. Loss of water is very serious to a centrifugal pump. It will destroy the pump in a very short time and possibly cause serious damage to the motor before it is removed from the line.

"Assuming constant head and speed on a centrifugal pump, any drop in the quantity of water supplied to the intake causes a drop in driving power required and hence a drop in line current to the driving motor. It would be very undesirable to shut down the pump on a slight blocking of the intake or on voltage fluctuations which cause current fluctuations. Therefore, a relay which will drop out at 60 to 70 per cent of normal line current is used. Such an undercurrent relay is inexpensive and easily connected in the circuit to the motor starter. It should be simple, strong, adjustable and, preferably, dustproof for coal-mining service.

"To install an undercurrent relay with the common manual auto transformer starter requires only a current transformer in one line to supply current to the relay and connection of the contacts of the relay in series with the low-voltage release circuit. As the low-voltage release does not act until the running position is reached, the relay cannot prevent operation of the starter. Where a magnetic starter is used, the contacts of the relay are placed in the 'Stop' circuit. In this case, the 'Start'

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No Utopia

• UTOPIA indeed would be a mining operation where machines never broke down, working conditions always were ideal and safety was an automatic proposition. However, there seems little prospect of this ideal ever being attained at a coal mine, although it can be approached by care in planning mining operations, proper maintenance of equipment and constant attention to the elimination of hazardous conditions and practices. Experience aplenty is available to operating, electrical, mechanical and safety men striving for this ideal. In fact, *Coal Age* is designed specifically to collect worth-while examples of this experience and pass them along to others who may be faced with similar problems. We have a place for your short cuts to more efficient and safer operation, too, and we urge you to send them in. A sketch or photo should accompany them if it will help to make them clearer. And each acceptable item will bring its sender $5 or more.

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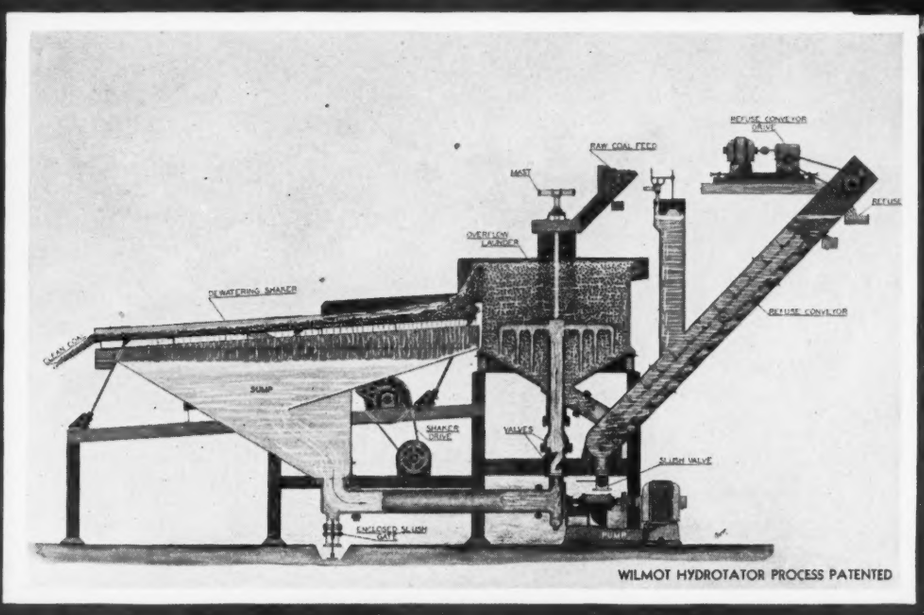

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Maximum recovery and a uniform marketable product is assured by the Hydrotator Process. In anthracite practice, the coal is accurately sized before passing into various Hydrotator Units for individual cleaning of the different sizes. Using two or more small, compact, high capacity units as pictured above, instead of one large unit for cleaning two or more sizes at one time, eliminates variation in cleaning efficiency of the various sizes . . . In bituminous practice a very much wider range of sizes may be washed in one unit, the size naturally depending entirely upon the quality of the coal and the nature of the reject . . . Individual Hydrotator Units are simple, positive, automatic and require minimum power, supervision and upkeep . . . Send for descriptive bulletins.

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HYDROTATOR

COAL CLEANING & CLASSIFYING

circuit is so connected that the contacts of the relay are out of the circuit during the starting period. This can be done readily in most cases without any auxiliary equipment or reconnecting the starter.

"Most of the pumps driven by d.c. motors are small and are not of the semi-automatic type. However, where desirable, a d.c. undercurrent relay can be applied to give the same protection as in the case of the foregoing a.c. drives. One precaution must be observed in using the d.c. relay, however: The d.c. voltage usually is subject to wide fluctuations and the wide current fluctuations are likely to cause false operations unless the relay is set for a very low drop-out point."

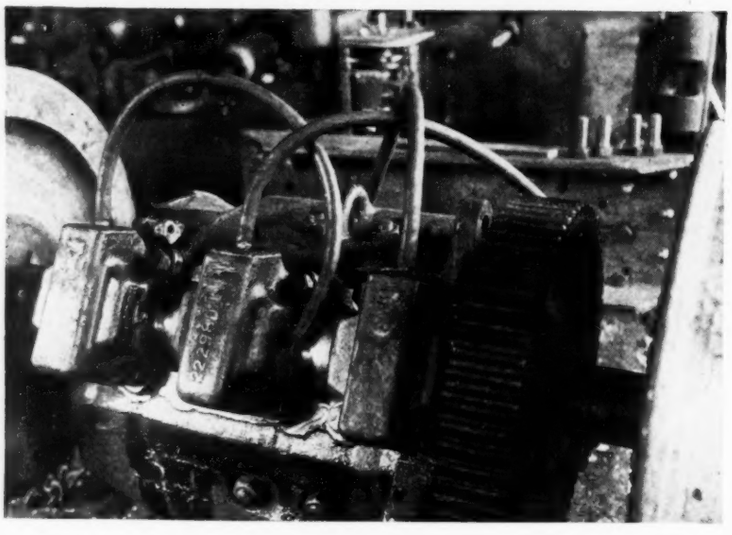
Two-Foot Axle Bearings Reduce Dirt Problem

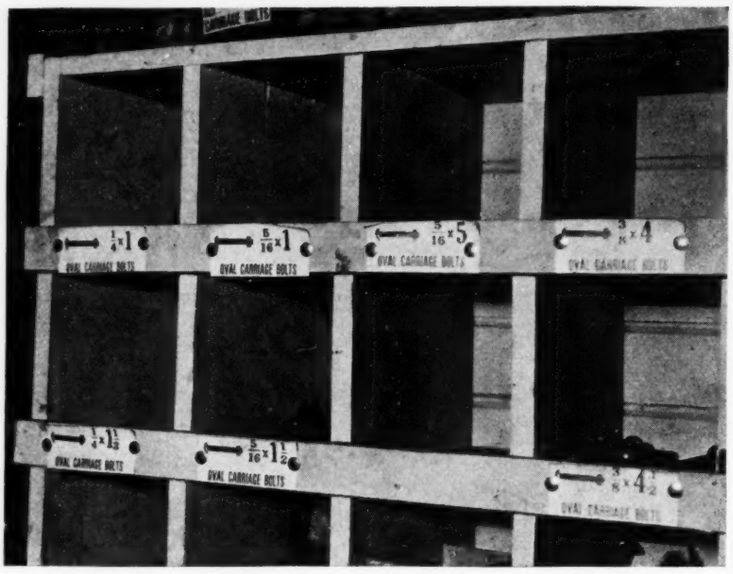
Redesigning and rebuilding parts of old equipment to reduce delays and repair cost can be an important function of a coal-mine maintenance department. The accompanying halftone made from a photograph snapped recently in a shop of the Koppers Coal Co., Glen White, W. Va., shows an axle bearing and lubrication improvement being applied to a Type 904 motor on a 6-ton inside-frame-design locomotive.

Both the journal and axle bearings of this type of locomotive wore extremely fast. Inaccessibility of the journal boxes for applying grease and the uncertain lubrication of axle brasses coupled with entrance of dirt were the causes. To facilitate journal lubrication by pressure gun the axle ends have been drilled longitudinally with ⅜-in.-diameter holes to meet ¼-in. holes drilled transversely at the journal centers.

In place of the two original axle brasses each 6½ in. long, which together presented four points for entrance of dirt, one continuous axle brass 26½ in. long was substituted. A third axle cap was added at the center and all three caps were fitted with welded nipple covers to accommodate short lengths of hose leading to convenient terminals for pressure lubrication.

Journal and axle bearings are fitted for positive lubrication and the latter bearings are guarded in a large measure against the entrance of dirt





Illustrated cards on bolt bins in the Jenkins warehouse

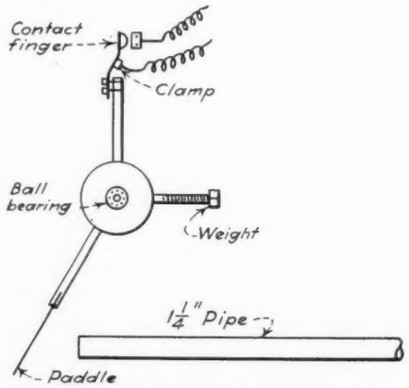
Pictures on Bolt-Bin Cards Reduce Warehouse Errors

Pictures of bolts added to bin description cards have proved advantageous in the central warehouse of the Consolidation Coal Co., Jenkins, Ky. It is to men new to the job of dispensing supplies and materials that the pictures are of the greatest help. With the numerous items kept in a mine warehouse it takes considerable time for any man to learn to identify unerringly a class of equipment such as the many types of bolts that must be stocked.

As indicated by the illustration, which includes a few bins containing oval-head carriage bolts, the printed card carries the size designation and verbal description as well as the picture. The latter is made as near life size as the card dimensions will permit. Besides reducing the chance of sending out the wrong bolts on an order, the picture discourages the practice of taking a bolt out of a bin to identify its type, and then perhaps by mistake putting it into a different bin. The same holds true when bolts from a new shipment are to be stocked into the bins.

Fan Stoppage Shown By Indicator

To provide a signal in case of fan stoppage, the device shown in the accompanying illustration has been worked out at the Consolidated No. 2 mine, Knox Consolidated Coal Corporation, Bicknell, Ind., reports Walter Pickel, top foreman. The



Diagrammatic sketch of fan operation indicator

fan in question is a new Aerodyne unit installed at the bottom of the downcast. A 1¼-in. pipe was tapped into the discharge end of the fan casing. Air through this pipe blows against a paddle mounted on a ball bearing. The paddle in turn holds a contact closed. If the fan should stop, the paddle drops back, opening the contact and breaking the circuit to a magnet weight, which drops and blows a steam whistle.

WORD FROM THE FIELD

Mineral Problems of Illinois To Engage Conference

Recent scientific and industrial developments of special significance to the mineral industries of Illinois will be stressed at the fifth annual Illinois Mineral Industries Conference, according to M. M. Leighton, chief of the Illinois State Geological Survey. The conference will be held Oct. 8 and 9 at Urbana under the joint sponsorship of the State Geological Survey, the Engineering Experiment Station of the University of Illinois and the Illinois Mineral Industries Committee.

Clyde E. Williams, director, Battelle Memorial Institute, will deliver the main address at the opening session, on "Research in the Mineral Industries." Other papers scheduled on the tentative program are: "Fuel Oil as a Competitive Factor in the Domestic Fuel Market," Marc G. Bluth, executive secretary, Committee of Ten—Coal and Heating Industries, with discussion by Walter H. Voskuil, mineral economist, Illinois State Geological Survey; "Changes in the Constitution of Illinois Coals Through Preparation Processes, and the Importance of These Changes in Utilization," L. C. McCabe, associate geologist, Illinois State Geological Survey; "Smoke-Prevention Measures and Illinois Coal," Osborn Monnett, Commercial Testing & Engineering Co.; "Trends of Coal Selection for the Domestic Stoker," K. C. Richmond, managing editor, *Coal Heat.* T. J. Thomas, president, Valier Coal Co., will preside at the second day's session.

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Consol Takes Safety Honors

Keen competition marked the contests at the sixth annual safety day meet of the Central West Virginia Coal Mining Institute, held July 31 at Jacksons Mill, W. Va., under the sponsorship of the West Virginia Department of Mines. Thirty-seven teams took part in the various contests, Consolidation Coal Co. men carrying off the lion's share of the honors. Owings No. 32 team of the Consolidation company took top honors in the first-aid contest for white mining teams after working off two tie problems. The winning team was composed of Victor Null (captain), Wayne Ashcraft, Earl Riley, John Haskins, John Null, Frank Hardman and Willford Mills. Second place went to the Grant Town team of the Koppers Coal Co., and third to Consolidation's No 86 team, from Carolina, the toss of a coin being necessary to a decision when the teams were still tied after working two additional problems.

The winner among colored teams was the Koppers outfit from Grant Town, with a score of 99.9 per cent. Watson boy scouts, sponsored by Consol, took first place in the junior division, with 99.3 per cent, followed by Consol No. 97 boys, with 98.25, and a girls' team from Consol No. 25, with 95.25.

A record-breaking crowd, estimated at close to 20,000, was in attendance and heard addresses by Governor Homer A. Holt, Daniel Harrington, chief, health and safety division, U. S. Bureau of Mines; Senator Lee Sandridge, Representative Andrew M. Edmiston and others. L. S. McGee, district mine inspector, Shinnston, was director of the meet, and J. J. Forbes, U. S. Bureau of Mines, Pittsburgh, Pa., was chief judge.

Keeping Step With Coal Demand

Bituminous Production

	1937 (1,000 Tons)	1936 * (1,000 Tons)
July 10	6,420	6,827
July 17	7,132	7,034
July 24	7,290	7,288
July 31	7,718	7,386
August 7	7,428	7,634
Total to August 7	268,687	244,357
Month of June	31,726	29,217
Month of July	31,610	32,005

Anthracite Production

July 10	667	845
July 17	575	795
July 24	473	819
July 31	565	1,145
Total to July 31	31,007	34,136
Month of June	4,475	4,306
Month of July	2,697	3,925

* Outputs of these two columns are for the weeks corresponding to those in 1937, although these weeks do not necessarily end on the same dates.

Bituminous Coal Stocks

	(Thousands of Net Tons) July 1, 1937	June 1, 1937	July 1, 1936
Electric power utilities	8,400	8,446	5,548
Byproduct coke ovens	7,770	8,188	4,565
Steel and rolling mills	1,539	1,588	874
Railroads (Class 1)	7,107	7,391	4,351
Other industrials*	12,262	12,556	7,615
Total	37,078	38,169	22,953

Bituminous Coal Consumption

	(Thousands of Net Tons) June, 1937	May, 1937	June, 1936
Electric power utilities	3,650	3,286	3,153
Byproduct coke ovens	5,788	6,434	5,325
Steel and rolling mills	968	1,153	1,045
Beehive coke ovens	439	520	148
Railroads (Class 1)	6,661	7,220	6,255
Other industrials*	9,998	10,764	8,126
Total	27,504	29,377	24,052

* Includes coal-gas retorts and cement mills.

Dr. Larkin to Succeed Gorman As Anthracite Umpire

Appointment of Dr. Thomas E. Larkin, educator and anthracite labor authority, as umpire of the Anthracite Board of Conciliation is expected to be announced by Judge Joseph E. Buffington, senior judge of the U. S. Court of Appeals in Philadelphia, when he returns from his vacation. The appointment has been recommended by the board, consisting of J. B. Warriner, president of the Lehigh Navigation Coal Co.; Martin F. Brennan, president of District 9, United Mine Workers, and John Boylan, secretary of the board.

The selection of an umpire for the board of conciliation reaches back to the great strike of 1902, which was finally settled when the anthracite mine workers and the operators agreed to abide by the findings of an investigating commission appointed by President Theodore Roosevelt. Under the awards of this commission a Board of Conciliation was created, consisting of three miners and three operators, to adjudicate any grievance or complaint arising out of working conditions around the mines. Where there should be a deadlock on disputes, provision was made to have one of the judges of the federal Court of Appeals in Philadelphia appoint an umpire, on the recommendation of the Conciliation Board, whose decisions on matters submitted to him were to be final.

34 Years of Labor for Peace

The Conciliation Board has functioned smoothly for over 34 years in settling disputes and grievances of employees and employers that arose out of working conditions under the anthracite collective agreement. Carroll D. Wright, Commissioner of Labor under Presidents McKinley and Theodore Roosevelt, acted as umpire for the board during its first year, when he resigned to become president of Clark University, Worcester, Mass. When Dr. Charles P. Neill became the second Commissioner of Labor for President Theodore Roosevelt, he was subsequently appointed umpire of the Board of Conciliation and continued in that capacity for 25 years until he resigned in 1929. James A. Gorman, secretary of the Board from its beginning in 1903, became the third umpire and served until his death last November.

Dr. Larkin is a native of Indiana and a graduate from the Jesuit school, St. Mary's College, Kansas, and also from the Catholic University of America, Washington, D. C. He entered educational work, first as a director of vocational schools, and subsequently taught economics and labor relations in different universities. He also did important work in the bituminous field for the U. S. Coal Commission of 1922-1923. During the last five years that Dr. Neill was umpire for the Board of Con-

Dr. Thomas E. Larkin

ciliation Dr. Larkin was his assistant and spent much of his time in the anthracite region. At the time of the dual union troubles in the Scranton-Wilkes-Barre area in 1934, Dr. Larkin assisted the late James A. Gorman when the latter acted as agent for the National Labor Relations Board in settling these disputes. Later he returned to the service of the government as an educator, first at the U. S. Penitentiary, Atlanta, Ga., and at the U. S. Southwestern Reformatory, El Reno, Okla.

To Study Coal-Mine Safety

Under the chairmanship of C. W. Gibbs, general manager, Harwick Coal & Coke Co., the mining section of the National Safety Council will hold sessions at the 26th annual safety congress, to be held Oct. 12-14 at Kansas City, Mo. Included in the program is a paper on "Safety Program for the Reduction of Accidents in Coal Mining," by Thomas Allen, chief coal mine inspector, State of Colorado, which will be followed by a discussion. In the course of a panel discussion on "Specific Accidents and Hazards and Their Elimination," John Lyons, safety engineer, Bell & Zoller Coal & Mining Co., will treat the subject in relation to bituminous coal mining, while John D. Cooner, safety inspector, Hudson Coal Co., will cover the anthracite side. J. J. Forbes, supervising engineer, safety division, U. S. Bureau of Mines, will speak on "Mining From the Viewpoint of the U. S. Bureau of Mines."

Pittsburgh Steel Buys Mines

To add to its coke supply, the Pittsburgh Steel Co. has purchased the Thompson No. 1, Thompson No. 2 and Tower Hill No. 2 mines, at Republic, near Uniontown, Pa., formerly operated by subsidiaries of the Hillman Coal & Coke Co. Combined capacity of the three operations, all of which are connected underground in such a manner that in effect they constitute a single unit, is 2,200 tons of coal a day, all of which is converted into coke in beehive ovens on the Thompson No. 2 and Tower Hill properties.

Coal Research Group Continues Studies On Stoker Combustion Problems

BEHAVIOR of various coals in different types of stoker equipment continues to have a large place in the studies undertaken for Bituminous Coal Research, Inc., by the Battelle Memorial Institute. Using investigational methods developed with coke as the experimental fuel, two series of tests with 1x0-in. Millers Creek coal have been completed by the Columbus (Ohio) research laboratory as part of a study of combustion in underfeed stokers. The first series, at burning rates comparable to those used in the experimental tests with ¾x¼-in. coke, led to the following general conclusions:

"1. Because of the caking of the fuel at the center of the bed, most of the burning takes place around the periphery of the retort. As a result of the segregation of the sizes of coal, the coarse near the hopper and the fine on the opposite side, and of the caking in the center, conditions are very erratic in different portions of the fuel bed. There is a high excess of air at all levels in the bed in the zone of coarse coal.

"2. The ignition level is higher in the retort than when burning coke. It is changed in position, as would be expected, with change in the rate of air supply. At the center of the bed the ignition level was at the top of the retort when supplying 80 per cent excess air and 3½ in. above the retort with 35 per cent excess air.

"3. Considerable cracking of hydrocarbons occurs near the ignition level. Tar and heavy oils condensed in the gas lines. Concentration of hydrogen up to 10 per cent and of methane up to 5 per cent were found a short distance above the ignition level.

"4. The well-defined zone of maximum temperature found in coke fuel beds was not evident when burning coal. This is due in part to the distribution of the combustion between the volatile matter which is liberated to burn above the fuel bed and in part to the different sizes of the pieces of fuel. As a result of the coking, many of the pieces of fuel burned are much larger than those fired and the reaction rates, therefore, are lower than they would be with small pieces.

Maximum Temperatures Lower

"5. The maximum temperatures found in the fuel bed were much lower than when burning coke at comparable rates of fuel and air supply; i.e., about 2,400 deg. F., as compared with 3,100 deg. F. with coke."

In the second series of tests, the rate of feed was unchanged, but the rate of air supply was varied. These tests showed that, although in general both the height of the ignition level and the depth of the fuel bed increase with a decrease in air rate, local variations in the fuel and air flow at positions near the periphery of the retort may mask this general result. A single series of measurements at one of the positions near the periphery, therefore, may not be representative of the typical conditions for the given air and fuel rate. Data at the center of the bed are less likely to be subject to such fluctuations and are more nearly representative.

The composition of the gas at various points in the periphery, reported C. A. Barnes, in charge of these studies, clearly shows the presence of cross-feed rather than under-feed burning. Variation in composition of the gas across the top of the fuel bed was less with coal at low excess air than with coke at higher excess air. In order to determine the flow of fuel through the retort, numbered corks were fed through it and a record made of the position and time at which these corks came out. The most rapid feed, it was found, is between the center and the back of the retort; i.e., away from the hopper. The rate of flow of coal is lower again at the back edge of the retort and also less at the front of the retort than at the back.

Small Stoker Report Published

Part II of Technical Report No. 1, "Relation of Burning Characteristics of Bituminous Coal to Their Performance on Small Underfeed Stokers," was published by Bituminous Coal Research, Inc., early last month. The volume also includes a summary of Part I, published some time ago. Work on the second part of the report was completed by the technical staff at Battelle in April. Since then, further tests have been made with Harlan High Splint, Illinois Nos. 5 and 6, Millers Creek, Pocahontas and Upper Freeport coals. In these tests the laboratory has been experimenting with a stoker which has a fuel-bed agitator designed to break up coke trees and maintain a fuel bed which would respond to demands for heat. These tests are under the direction of H. R. Limbacher and H. N. Ostborg.

Field studies of the use of bituminous coal on industrial underfeed stokers were summarized in a confidential report submitted to the directors of Bituminous Coal Research, Inc., and National Coal Association. This report recommended the publication of two information booklets, one for the plant engineer and the other for the purchasing agent, to guide them in the selection of coal. This idea also was suggested by Dr. A. W. Gauger, Pennsylvania State College, at a meeting of Committee D-5 (Coal and Coke) of the A.S.T.M. As a result, the following subcommittee of the A.S.T.M. group has been named: E. R. Kaiser, who has supervised the Battelle studies on the subject; J. F. Barkley, engineer, U. S. Bureau of Mines; J. B. Morrow, preparation manager, Pittsburgh Coal Co., and chairman of the technical advisory committee of Bituminous Coal Research; J. E. Tobey, manager, engineering division, Appalachian Coals, Inc.; and G. B. Gould, president, Fuel Engineering Co. of New York.

Analysis of results of tests in the segregation of sizes in delivery from the bunker of a stoker-fired boiler has been embodied in a report which has been submitted to the technical advisory committee for action. In addition to segregation resulting from the rolling of the coarser coal to the edges of the cone formed in filling the hopper, the study also disclosed that a segregation of pieces because of differences in

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density resulted. As the denser pieces were those higher in ash, a large change in the ash content of the larger sizes occurred with time.

Following this analysis, a model bunker in which 3/8x0-in. coal could be used for experimentation was employed. Segregation of sizes discharged from this bunker, it was found, was almost exactly of the same nature and degree as with coal from the large power-plant bunker. Next experiments on the effect of change in the filling point of the bunker were undertaken. These experiments involved filling the hopper immediately over the discharge spout and at different points between the discharge spouts. Contrary to expectations, however, filling the hopper between the discharge spouts did not decrease the segregation. Further tests to determine the effect of deflecting plates, angles and partitions will be made.

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Bin-Feed Firetender Ready

A new stoker, known as the bin-feed Firetender, has been placed on the market by the Holcomb & Hoke Manufacturing Co., Indianapolis, Ind. Having a coal-burning capacity of 12 to 25 lb. per hour, the new unit is strongly built, having a feed worm made of high-grade alloy screw steel with high tensile strength. The fan, which is oversized, is designed for silent operation, and the retort also is polished to reduce friction. The tuyeres are the self-cleaning type, overlapping to reduce air leakage. A large cast-iron inclosure is provided just outside the coal bin, and adjacent to this is an improved clean-out and obstruction catcher, making it possible to reach any obstruction from either side or both. The controls include a low-voltage thermostat, relay hold-fire control unit to prevent the fire from going out and a limit control to prevent the furnace or boiler from overheating.

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Sees Hard Coal on Upgrade

The decrease in anthracite output from 1914 to 1934, according to the Heating and Air-Conditioning Information Bureau, New York, now shows evidence of turning into a clearly revealed twenty-year rise. Ninety per cent of the homes built in the next 20-year period in the area where anthracite is sold, says the bureau, will be equipped with hard-coal heating plants and hot-water systems. High-priced homes, it adds, will have completely automatic anthracite heat, while lower-priced homes will have semi-automatic heating. The predicted rise, according to the bureau, will be based largely on the reestablishment of anthracite as America's No. 1 domestic fuel.

Because of the vastly increased efficiency of hard-coal-burning equipment, the quantity of fuel used by each home will be 10 to 20 per cent less than that used by the same type of home in 1914. The greatly increased number of homes equipped with anthracite-burning heating plants, however, says the bureau, will provide a long-term market that will tend to stabilize the industry as a whole and result in an ever-growing demand for this fuel as each year marks the construction of more homes.

Coal Commission Clears the Way To Expedite Price Fixing

WASHINGTON, D. C., Aug. 17—Final proceedings looking to the establishment of minimum prices were initiated by the National Bituminous Coal Commission today. An order requiring all district boards east of the Mississippi, except Alabama, to file their minimum prices by Sept. 2 sets Sept. 27 as the date for a hearing at which the coordination of the district prices in Minimum Price Areas Nos. 1 and 2 will be considered.

To facilitate determination of these minimum prices by the district boards the Commission's order tentatively sets the weighted average cost of production in Minimum Price Area No. 1 at $2.22 per net ton and in Market Area No. 2 at $1.88. While these figures are subject to change before the Commission finally approves the district boards' proposed prices, it was stated at the Commission that with the knowledge gained during operation of the previous act and the data already filed as to costs with the Commission's 23 statistical bureaus for 1936 and 1937 under the present act, it is not likely that there will be any important change in the tentative costs now set.

Following filing of these proposed minimum prices by the district boards on Sept. 2, the Commission has convened for Sept. 8, at Washington, a meeting of duly elected representatives of the district boards at which the coordination of the district prices for the market areas will be begun. Today's order then requires that this coordination be completed by Sept. 23 and that the coordinated prices be on file and open for public inspection in the offices of the secretary of the Commission on and after Sept 24.

Hazard Asks Prompt Control

The Commission's announcement came four days after a plea by telegraph from the Hazard Coal Operators' Association to President Roosevelt, the Coal Commission and John L. Lewis, United Mine Workers president, as well as to their Senators and Representatives for prompt publication of prices by the Commission. The telegram said that "if our mines are to remain in operation and support the present wage structure, it is imperative that price control be made effective promptly."

Action on the price situation was foreshadowed yesterday when the Commission established standards of classification, on which hearings were held at the Carlton Hotel on July 15-16. The order limited the standards to the chemical, physical and performance characteristics of the coal itself without reference to market history, uses and other factors which, the Commission determined, will be considered subsequently in setting up the minimum prices and marketing rules for the ten market areas established by the Bituminous Coal Act. In the classification order the standards were set forth as follows: (1) proximate analyses; i.e., moisture, ash, volatile-matter, fixed carbon and sulphur, B.t.u. content and ash-softening temperature, analyses of ash and ultimate analyses of coal; (2) physical characteristics; (3) characteristics of performance.

The order requires the district boards to give due consideration to all necessary and ascertainable information concerning these standards with respect to the various kinds, qualities and sizes of coal mined and shipped by all code members within each district. All coal must be classified fairly and equitably as between producers and as between districts. The classifications will apply to the coals as of the time and place when preparation for market is completed by the producer at the mine or at facilities normally considered mine adjuncts. All code members are required to furnish information pertinent to this classification on forms supplied by the boards within ten days of receiving those forms, this information to include the kinds, qualities and sizes produced.

While this information will be available to the Commission upon its request, it will be held confidential by both the Commission and the boards except as necessary in carrying out the provisions of the act and decisions of the Commission. If any producer fails to supply the information, the district boards are instructed to proceed with the classification of his coals on such information as they may acquire.

Order Provides for Appeal

The order provides for filing these classifications and for proceedings whereby any producer who believes his coals, or other coals, have been inequitably classified may appeal to his district board and the Commission for a hearing and change of classification. There also is provision for reclassification on the initiative of a producer, a Board or the Commission.

Rules also are provided in the order for the taking of samples of coal for analyses in accordance with Bureau of Mines Technical Paper No. 139 (1933), entitled "Directions for Sampling Coal for Shipment or Delivery." The district boards may require samplings for three successive days and producers are required to permit access to coal being loaded for inspection and sampling.

Screen analyses of coals are to be carried out in accordance with the "Proposed Tentative Method of Test for Screen Analysis of Coal" adopted by the American Society for Testing Materials in 1935. Analyses may be made at any established laboratory recommended by a district board and approved by the Commission and, in the event of disputes or differences in analytical results, the Bureau of Mines laboratories or other impartial laboratories may be used.

That serious consequences would result if Iowa coal was permitted to be sold without regulation by the National Bituminous Coal Commission was oft reiterated at a hearing at Des Moines, Iowa, on Aug. 9-11. This was the second of a series of hearings to be held in various parts of the country, the first of which was held at Columbus, Ohio, July 28-29. The Des Moines hearing established without question, said Robert W. Knox, general solicitor of the Commission, that coal produced in Iowa directly affects coal in interstate commerce and therefore should be subject to the Bituminous Coal Act. An unusual array of coal producers, coal-marketing

authorities, coal-freight officials and coal statisticians was heard, and in addition numerous truck-mine operators were present and represented by counsel.

The testimony developed that Iowa truck mines as well as Missouri truck mines have made steady gains in the last four years and it also was established that much of the interstate coal being sold in Iowa is transported by truck. Furthermore, it was shown by evidence and exhibits that Iowa coals, both truck and rail, are in active and close competition with coal brought into the State from Illinois, Indiana, West Virginia, eastern and western Kentucky by direct rail and from Lake Superior and Lake Michigan docks. Officials of the largest Iowa rail mines were unanimous in declaring that unless all Iowa coal is regulated there will be an inevitable and disastrous reduction in the tonnage of interstate coal and they themselves will be forced to withdraw from the rail field and transport their output by truck exclusively.

F. G. Tryon, head of the statistical bureau of the Commission, said that three times as much coal is consumed in Iowa as is produced in the State. If market conditions permitted or if it was necessary, however, much more coal could be produced in the State. Working 161 days in 1935 on an average, Iowa mines produced 3,653,000 tons, whereas if the mines were to operate 262 days, or each normal working day, production could be increased to 5,500,000 tons. Truck and wagon-mine production, he said, had increased from 837,282 tons in 1926 to 1,860,906 tons in 1936, a gain of 112.1 per cent, On the other hand, shipments by rail outside of the State fell from 169,535 tons in 1926 to 34,541 tons in 1936, a decline of 79.5 per cent; rail shipments within the State slid from 1,319,192 tons in 1926 to 1,131,141 tons, a loss of 14.2 per cent. Much of the testimony of Mr. Tryon with regard to production was reiterated by G. D. Miller, auditor of Iowa Coals, Inc.

Truck-Coal Control Asked

Prices would be demoralized if trucked coal was allowed to be sold unregulated, declared M. G. Youngquist, general manager, Iowa Coals, Inc. In the absence of such control, no one would ship by rail. Furthermore, he said, if Iowa coal was unregulated it would have an unsettling effect on regulated coal.

Truck-mine competition in Iowa, according to Edward L. Carr, assistant to the president, Bell & Zoller Coal Co., Chicago, has spread from 25–35 miles to 50–75 miles from mining districts, with improved highways. He also advised that all groups be placed under price control, regardless of the method of transportation. The fact that a steam-coal user submits inquiries on different grades of coal, he added, establishes a definite relationship between all bituminous coal for application in industrial steam plants. R. B. Starek, manager of Eastern sales, Old Ben Coal Corporation, Chicago, declared that sales of Eastern coal in Iowa have been declining since 1929, and unless Iowa coal is regulated that import tonnage will continue to decline and eventually disappear from the Iowa market.

Iowa coal, said K. G. Carney, president, Consumers Consolidated Coal Co., and secretary, Scandia Coal Co., costs more to produce than other Western coal, but, because of favorable freight rates, has been able to compete successfully with outside coal in the home market. Jacob Ritter, secretary, Old King Coal Co. and Sterling Coal Co., said that 30 per cent of the coal consumed in his market area was trucked in from Missouri mines and sold for less than it cost him to produce. He cited an instance of a trucker, whose vehicle bore a Missouri license, who endeavored to sell him a ton of coal for $2. He examined the product and found that it would have cost him $2.64 to produce the same coal. It was his opinion that truck-mine operators paid their workers 25–35 per cent less than rail mines and he declared that if prices were regulated under the provisions of the Bituminous Coal Act, wages unquestionably would be stabilized.

Rail mines could not stay in business if they were regulated and truck mines were permitted to operate without regulation, said S. V. Carpenter, secretary, Sunshine Coal Co. Arthur Larson, W. E. Johnson and T. H. Lundgren, all operators of truck mines, admitted that if Iowa truck-mine coal was allowed to be sold without regulation they would have an advantage over Iowa regulated coal as well as coal produced in other States and sold under regulation.

At a two-day hearing held in Columbus, Ohio, July 28 and 29, witness after witness declared that only through regulation of all bituminous coal produced in Ohio could chaos be averted for producers in other fields which are regulated and which are competitive with the Ohio field. Unless Ohio coal is regulated, said J. O. Terrio, executive secretary, District 6 Producers' Board, West Virginia Panhandle mines will lose much of their business in Ohio. Failure to regulate Ohio prices, he declared, would create a ridiculous differential against interstate coal that must be sold under regulation. "Ohio producers are their own worst competitors," he said; "they have engaged in cut-throat competition, and if the price of Ohio coal is not regulated it will be sold at prices much below the cost of production and seriously interfere with, if not completely block, the flow of interstate coal."

He stressed the handicaps of storing coal and said that producers in regulated areas would be at a disadvantage in competing with unregulated producers in disposing of certain sizes under varying conditions of market demand and consumption. Under questioning by F. E. Huhlein, representing the Consumers' Counsel, Mr. Terrio said that, in his judgment, no consuming areas in the State depended exclusively on Ohio coal. The belief that unregulated Ohio mines would engage in cut-throat competition was voiced by a number of other witnesses.

Questioned by Examiner Acret as to whether Ohio consumers might benefit if intrastate coal was exempt from the coal code, Charles W. Shinnamon, executive secretary, District 3 Producers' Board (northern West Virginia), gave it as his opinion that there would be no lasting benefit to them. In regard to the small domestic consumer, he recalled that in coordination agreements arrived at between various districts shipping into New England, prices arrived at under the Bituminous Coal Act of 1935 would actually have been much lower to domestic consumers than the prices in effect last winter.

Regulation Insures Fair Prices

The effect of regulated prices on industrial consumers, said Mr. Shinnamon, will be to make fair prices for the first time on the same coal for each consumer, since large consumers will no longer be able to play one operator against another or one field against another in driving a hard bargain.

A. L. Lynn, executive secretary, District, 7 Producers' Board (Southern No. 1), gave substantial and convincing evidence of the extent of interstate commerce in coal in Ohio and the effect upon it of intrastate shipments in 69 of the 88 counties of the State. F. G. Tryon also presented a number of exhibits. Other witnesses who testified that Ohio coal directly affects interstate commerce were E. C. Streible, Pittsburgh Coal Co.; H. A. Thompson, sales manager, Carnegie Coal Corporation; T. E. Jenks, Chesapeake & Ohio coal freight auditor; Roy Carson, traffic manager, Harlan County Coal Operators' Association, and John A. Emslie, Koppers Coal Co.

Proposed rules and regulations completely covering the distribution of coal from mine to consumer were submitted to the Commission at its hearing at the Carlton Hotel, Washington, on Aug. 3 by the American Wholesale Coal Association through W. W. Bayfield, its executive secretary. The plan calls for the registration of all distributors with the Commission and their agreement not to cut prices or exceed discounts or otherwise violate the

Coming Meetings

- American Chemical Society: annual meeting, Sept. 6–10, Rochester, N. Y.
- Railway Fuel and Traveling Engineers' Association: annual meeting, Sept. 28–30, Hotel Sherman, Chicago.
- West Virginia Coal Mining Institute: annual meeting, Oct. 1, Morgantown, W. Va.
- West Virginia Safety Day: mine-rescue meet and first-aid contest, Oct. 2, Mt. Hope, W. Va.
- National Coal Association: annual meeting, Oct. 7 and 8, William Penn Hotel, Pittsburgh, Pa.
- Illinois Mineral Industries Conference: fifth annual meeting, Oct. 8 and 9, Urbana, Ill.
- Coal Producers' Association of Illinois: annual meeting, Oct. 12, Springfield, Ill.
- National Safety Council: 26th annual safety congress, Oct. 12-14, Kansas City, Mo.
- Northern Wyoming Coal Operators' Association: annual meeting, Oct. 15, Casper, Wyo.
- Coal Division, American Institute of Mining and Metallurgical Engineers: annual meeting, Oct. 27 and 28, William Penn Hotel, Pittsburgh, Pa.
- Illinois Mining Institute: annual meeting, Nov. 5, Hotel Abraham Lincoln Springfield, Ill.

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code and the Commission's regulations. It included a well-developed scheme for the election of a National Distributors' Board, which Mr. Bayfield described as an effort of the sellers to maintain a contact with the Commission analogous to that afforded by the act to the producers through the district boards.

John L. Steinbugler, representing District Boards 1 to 4 and 6 to 11, including almost 90 per cent of the bituminous output, presented a draft of the rules for distributors' discounts agreed upon by those boards. They differed only in detail from those presented on behalf of the wholesalers' association. In defining the terms to be used in establishing the right of the various functionaries to discounts allowed under the coal act these were used: general sales agents, sales agents, wholesalers, various kinds of transshippers, and lake and tidewater forwarders. Though both plans provide for registration of the distributors with the Commission, the producers' plan did not set up a distributors' organization.

In an effort to exempt general sales agencies and sales agencies from direct control of the Commission, George W. Reed, representing Illinois producers, said he could not conceive of the Commission having power to regulate what he paid salesman on his own payroll. Conceding that in the past the unscrupulous have used the sales agency as a device to evade price regulation, to cut prices below the minimum set and to produce many of the troubles from which the industry suffers, he added that never before has such direct responsibility been placed on the producers.

As evidence of a general disposition to simplify the classification of distributors, W. E. Blucher, representing District 15 (Southwestern), advocated restricting the designation of distributors to two classes, general and jobbers, and urged that there be no discounts to farmers' cooperatives. Earl Cobb, representing District 14 (Arkansas-Oklahoma), urged the Commission not to permit too large a spread in prices between producer and ultimate consumer.

Cooperative Commissions Argued

E. L. Kreger, representing the Farmers' Elevator Service Co., a cooperative handling purchases and sales for 60 per cent of the organized farmers of northern Iowa and for 15 per cent of those in the southern part of the State, expressed the belief that commissions should be allowed only to those farmers' cooperatives which actually functioned as wholesalers. On the other hand, Donald Kane, general counsel for the National Cooperative Milk Producers and the National Grange, insisted that the Guffey-Vinson Act required that producers be enabled to grant discounts to all cooperatives on the basis of the quantity of coal they purchase rather than on the basis of their fluctuation as wholesalers or retailers. Mr. Kane estimated that there are 10,000 farmers' cooperatives in the United States and that 5,000 of them are dealing in bituminous coal for their members. There are 55 cooperative milk associations in his organization representing 350,000 farmers, he said, and the Grange has about a million members.

Commisisoners Maloney, Haymond and Tetlow held a hearing on July 27 at the Carlton Hotel, Washington, on the application of Alabama Coals, Inc., for provisional approval as a marketing agency. Herbert S. Salmon, president of the agency, revealed that its membership of seventeen producers, all of whom are code members, accounts for 64 per cent of the total production in the State. He stressed the keen competition of natural gas and fuel oil, which has been steadily increasing, pointing out that output of bituminous coal in Alabama declined from approximately 18,000,000 tons in 1929 to 11,000,000 tons in 1936. Appalachian Coals, Inc., completed presentation of its case on the same day.

William R. Chedsey

Sales Agency Approval Asked

In making application for approval as a marketing agency the Smokeless Coal Corporation presented figures to show that in 1936 it shipped 48 per cent of the tidewater tonnage to ports north of Charleston, 22.2 per cent of Lake Erie shipments, including cargo and bunker fuel, 32.4 per cent of Canadian all-rail shipments, and 32 per cent of the shipments to the Chicago district. William G. Caperton, president of the agency, added that the production of the smokeless coal fields in 1936 totaled 49,000,000 tons of commercial coal, and that of this, 56.4 per cent was produced by members of the Smokeless corporation. Testimony has been completed also on applications for tentative approval as marketing agencies by Peale, Peacock & Kerr and the Rochester & Pittsburgh Coal Co. Hearings on similar applications of Iowa Coals, Inc., and J. H. Weaver & Co. have been continued.

Applications have been heard for exemption from the code as captive producers from Alleghany-Pittsburgh Coal Co. and the Windsor Power House Coal Co., subsidiaries of the West Penn Power Corporation, and the Vesta and Shannopin coal companies, subsidiaries of the Jones & Laughlin Steel Corporation. Hearings are to be held later on similar applications by the following:

American Zinc & Chemical Co., Birmingham Water Works Co., Blair Engineering & Supply Co., Cambria Clay Products Co., Columbia Steel Co., Consolidated Indiana Coal Co., Consumers Mining Co., Cottonwood Coal Co., Elk Lick Coal Co., Emperor Coal Co., Harwick Coal & Coke Co., Harbison-Walker Refractories Co., McLain Firebrick Co., Muskingum Coal Co., Northwestern Improvement Co., Pennsylvania Electric Co., Pittsburgh Steel Co., receivers of Seaboard Air Line Railway Co., Republic Coal Co., Superior Coal Co. of Illinois, Union Pacific Coal Co., United States Steel Co. subsidiaries, Valier Coal Co. and Western Coal & Mining Co.

Personal Notes

JOSEPH ADAMS has been appointed foreman at the Freeport mine of the Howard Collieries Co., Chattaroy, W. Va.

J. G. BENTLY, for the last ten years chief fuel engineer for the Sahara Coal Co., Harrisburg, Ill., has been appointed district manager for the Johnson-March Corporation of New York, to be in charge of the second Coalaid plant, now under construction at West Frankfort, Ill.

DR. STEPHEN P. BURKE, formerly director of the industrial science division, West Virginia University, and more recently consulting engineer in Washington, D. C., has joined the staff of the Consolidation Coal Co. in the capacity of director of technical research. In addition, he will represent the company on District 3 Bituminous Coal Board (Northern West Virginia) and will assume such other duties and responsibilities as may be assigned.

FRANK D. CAIN, formerly secretary of the West Kentucky Coal Bureau, has been appointed acting district manager of the statistical bureau for District 9, Bituminous Coal Producers' Board, with offices in the Starks Building, Louisville, Ky.

A. B. CANTERBURY has been made foreman at the Buffalo Chilton No. 1 mine of the Buffalo Chilton Coal Co., Kistler, W. Va.

FRANK CASEY has been named foreman at the Riley No. 3 mine of Buffalo Eagle Mines, Inc., Braeholm, W. Va.

FRANK E. CASH, U. S. Bureau of Mines, Birmingham, Ala., was elected president of the newly reorganized Safety Engineers Club of Birmingham on Aug. 12. HUBERT E. MILLS, Alabama Mining Institute, was chosen secretary-treasurer. Twenty-five safety engineers representing all types of industries in the Birmingham district attended the first meeting. Meetings will be held at 12:15 p. m. the third Wednesday of each month.

Z. B. CHAPMAN has been appointed foreman at the No. 11 mine of the Island Creek Coal Co., Monaville, W. Va.

WILLIAM R. CHEDSEY, professor of mining, School of Mineral Industries, Pennsylvania State College, State College, Pa., where he has given 21 years of service, has accepted appointment as director of the Missouri School of Mines and Metallurgy, Rolla, Mo. He succeeds Dr. Charles H. Fulton, who has resigned, after heading the latter institution for seventeen years.

G. E. CLINE has been named foreman at the Wyoming mine of the Red Jacket Coal Corporation, Wyoming, W. Va.

W. F. COOK has been made foreman at the No. 3 mine of the C. H. Mead Coal Co., Eastgulf, W. Va.

D. H. CROGAN has been appointed foreman at the Point Lick No. 4 mine of the Hatfield-Campbell Creek Coal Co., Rensford, W. Va.

O. A. CUNNINGHAM has been named superintendent at the Dabney mine of the Hutchinson Coal Co., Kleenkoal, W. Va.

HENRY FERGUSON has been made fore-

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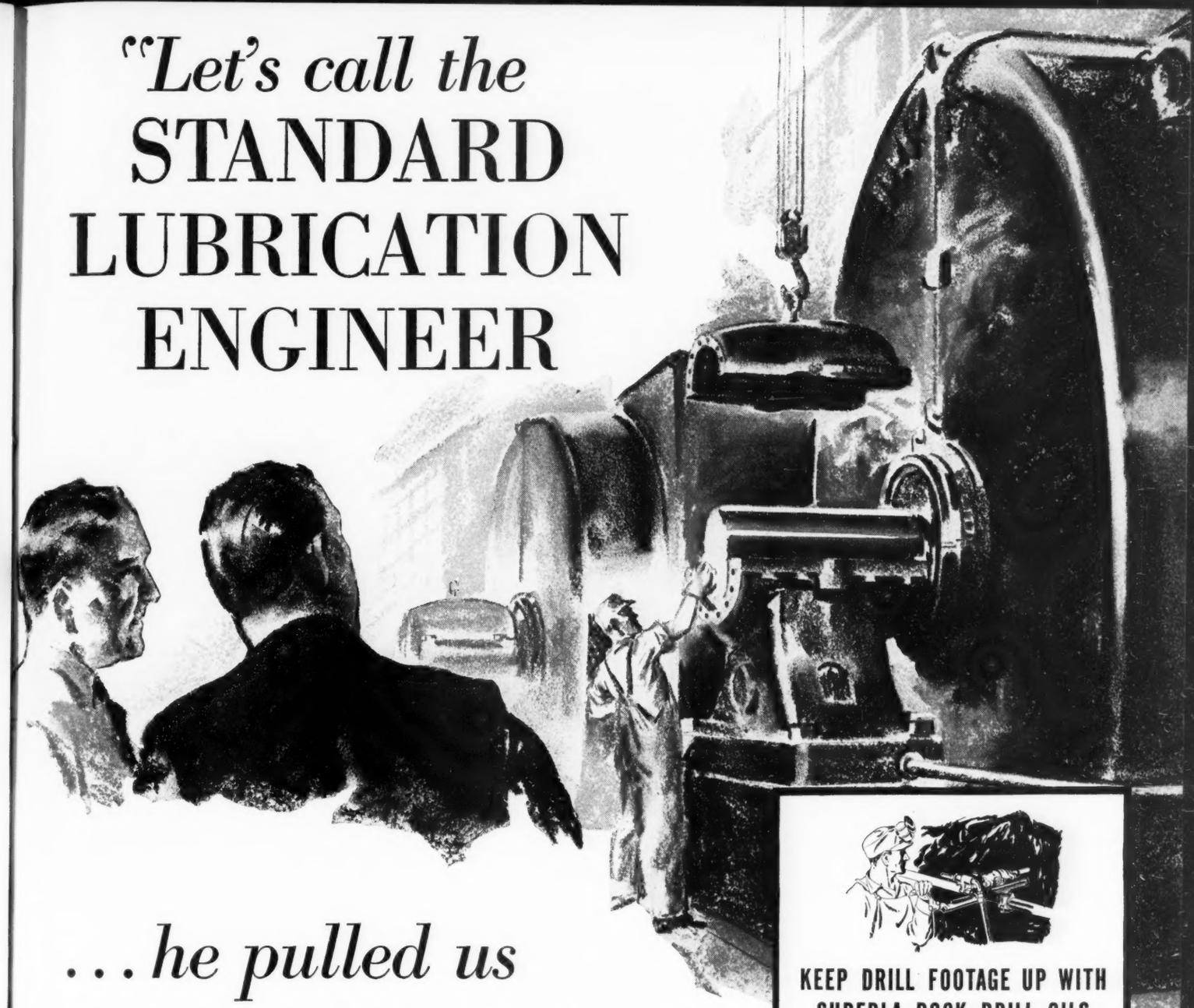

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man at the William Ann mine of D. H. Pritchard, contractor, Delbarton, W. Va.

ROBERT FLYNN has been appointed safety inspector at Wylam mine of the Tennessee Coal, Iron & Railroad Co., Wylam, Ala.

O. J. FRANKLIN has been named foreman at the No. 116 mine of the Kanawha & Hocking Coal & Coke Co., Longacre, W. Va.

HERMAN M. GRIGGS, manager of the Ore and Coal Exchange, Cleveland, Ohio, has resigned because of ill health. He had filled the post since 1918, when the exchange was organized. His business career began in the railroad industry more than fifty years ago and in 1910 converged to the coal industry, when he became coal and ore agent for the New York Central. In 1917, when the United States entered the World War, he was drafted into the service of the Lake Erie Bituminous Coal Exchange.

J. E. HEATHERMAN has been made foreman at the Gordon No. 3 mine of the Detroit Mining Co., Gordon, W. Va.

THOMAS KENNEDY, secretary-treasurer, United Mine Workers, as well as Lieutenant Governor of Pennsylvania, has been appointed honorary chairman of the Pennsylvania Constitution Commemorative Committee by Governor Earle.

JOHN T. KMETZ, for many years an executive board member of District 1, United Mine Workers (Scranton, Pa.), has been appointed international board member for that district. He succeeds the late Dennis J. Brislin, who announced his retirement several months ago. Mr. Kmetz's position as board member will be filled by Frank Shiffka, hitherto district organizer.

GEORGE LARUE has been named superintendent at the Monarch mine of the Kanawha By-Products Coal Co., Cedar Grove, W. Va.

JOHN LAWTON has been made foreman at the Vera Nos. 1, 2 and 3 mines of the Vera Pocahontas Coal Co., Iaeger, W. Va.

WILLIAM LOWE has been appointed foreman at the Ethel No. 2 mine of the Chilton Block Coal Co., Ethel, W. Va.

JOSEPH MAIER has been named superintendent at the Costanzo mine of the Wheeling Coal Co., Wheeling, W. Va.

A. F. MARSHALL, formerly associated with the Davis Coal & Coke Co., Thomas, W. Va., as assistant to the president, has been appointed an investigator of field work by the Bluefield (W. Va.) statistical bureau of the National Bituminous Coal Commission. At one time he was general superintendent of the Coalwood operations of the Consolidation Coal Co. and later became labor commissioner of the Pocahontas Operators' Association.

MATTHEW MARTIN has been made safety inspector at the Hamilton mine of the Tennessee Coal, Iron & Railroad Co., Pratt City, Ala.

HARRY C. MCCRORIE has been named safety inspector at the Docena mine of the Tennessee Coal, Iron & Railroad Co., Adamsville, Ala.

GEORGE N. MCLELLAN, formerly chief engineer, Coal Operators' Casualty Co., Greensburg, Pa., has accepted the position of safety engineer for the Weirton Coal Co. and is to be stationed at the Isabella mine, Isabella, Pa. He also was at one time connected with the Butler Consolidated Coal Co., Wildwood, Pa.

WALTER NIXON has been appointed foreman at the Costanzo mine of the Wheeling Coal Co., Wheeling, W. Va.

JOHN RAYMOND has been made foreman at the MacBeth mine of the Hutchinson Coal Co., MacBeth, W. Va.

A. M. ROBINSON has been named superintendent at the Premier Pocahontas Collieries Co., Premier, W. Va.

J. L. ROBINSON has been appointed general foreman at the No. 4 mine of the Raleigh-Wyoming Mining Co., Edwight, W. Va.

GEORGE A. ROOS, assistant general manager, Philadelphia & Reading Coal & Iron Co., has been promoted to general manager, succeeding John R. Sharp, who has been made director of industrial relations. Mr. Roos joined the company in 1903 as a slate picker, entered the engineering corps and became division engineer of the St. Clair division. During the last twenty years he has held various supervisory posts.

JOSH SAMMONS has been made general mine foreman at the United Splint mine of the Truax-Traer Coal Co., Wevaco, W. Va.

F. O. STOUT has been named foreman at the No. 3 mine of the Raleigh-Wyoming Mining Co., Hazy, W. Va.

J. A. WELCH has been appointed chief inspector of the division of mines of Tennessee, succeeding A. W. Evans.

L. E. WOODS, who for some time has been president of the Crystal Block Coal & Coke Co. and Crystal Block Mining Co., with operations in Logan and Mingo counties, West Virginia, has been appointed chairman of the board of directors of the Red Jacket Coal Corporation, operating in Mingo and Wyoming counties. He was at one time a State Senator and has been prominent in the West Virginia coal industry for some years.

GEORGE YEAGER has been made superintendent of the Emily mine of the Monongahela Rail & River Coal Corporation, Morgantown, W. Va.

WPA Funds Sought for Backfilling Scranton's Mine Labyrinth

SCRANTON, PA., Aug. 14—Citizens of this city, are planning to submit to President Roosevelt and H. L. Hopkins, National Works Progress Administrator, a plan to have the W.P.A. fill voids under the city caused by the extraction of coal. The cost of the work, it is estimated, will be $15,000,000 and the project will keep 440 persons steadily employed for ten years. Boreholes will be drilled, and material from culm banks flushed into the voids. Mayor S. J. Davis will head the committee of five or more to interview federal officials. F. C. Walker, former chairman, National Emergency Council, and Representative P. J. Boland will be asked to join in the conference.

Action is being delayed until the Glen Alden Coal Co. will consent to sign the nine-point agreement to which five other major coal companies have assented. This agreement pledges the producers to furnish available maps, service and data, to permit use of existing openings where such use does not interfere with operation, to transport equipment and supplies as near to flushing areas as is possible with facilities already available, to inspect areas being flushed, to provide locations for pumping stations with requested reimbursement of companies if water seeps to lower levels and has to be ejected, to afford surface space for crushing plants and underground space for timber and materials used in flushing, to provide such culm for flushing as is available in banks of unrecoverable value. The project is to be so conducted as not to interfere with ventilation.

From under the city of Scranton, a town of 143,428 inhabitants, according to the 1930 census, the third city in Pennsylvania, 300,000,000 tons of coal has been extracted by mining since 1841. For many years backfilling of the spaces thus excavated has been proposed as a means of supporting the city and defending it against the squeezing of pillars. In 1910–11 Eli T. Conner and William Griffith reported on the possibility of flushing the mine areas, but nothing was done in this regard.

On Feb. 26, 1936, a report was made by J. R. McCormick and S. J. McDonald, who, under the auspices and with funds of the Public Works Administration and the sponsorship of the City Planning Commission, had made a survey of the existing conditions known as Project No. 4073. They urged that a sum of $1,336,589 to $3,952,382 be expended in flushing parts of the area, using, as far as possible, hand labor in excavating the material to be used and in loading and unloading it at points from which it was to be flushed; the "labor to be performed by the members of the United Mine Workers of America at the prevailing wage scale in force between the union and the mine operators." Reasons set forth for the work are the preservation of life, of homes, buildings, streets, water mains and sewers, and to provide for the ultimate extraction of the coal and the maintenance of the progress of the city, as also the opportunity to put to work a large number of idle men. Recent agitation has urged that $50,000,000 be expended instead of the more conservative figures set forth in the report, but the final decision is to limit the project to an expenditure of $15,000,000.

In planning the method of flushing, the entire area was divided into thirteen parts of greatly varying size, each area manifesting its own peculiar problems. However, only eight of these were given careful consideration and are definitely mentioned in the body of the report.

1. *Se-Rob area,* to the west of and across the Lackawanna River from the central

portion of the city. Here the Eight-Foot bed, the uppermost coal measure of any to be found in Scranton, was mined by the Se-Rob Coal Co. Most of the ten beds below the cap bed form parts of the Hyde Park mine property of the Glen Alden Coal Co. Of the 32.4 acres which has been mined in the Eight-Foot bed, 5.13 acres under St. Patrick's Parish property has been either rock-packed or flushed. As it is probable that this mine, which has been closed since 1925, cannot be entered, boreholes doubtless will have to be sunk to it and flushing material passed from these holes to go where it will until the holes block. This is known as "blind flushing." However, new openings may have to be made by excavating material which fell into the mine when the unsupported measures caved, forming what locally are known as "pot-holes." Most of these holes have been filled with ashes. Other openings in the old mine workings also may have to be made. The report estimates that about twenty boreholes will be needed and that the depth of the bed below the surface is from 15 to 45 ft.. Water for flushing will have to be purchased from the Scranton Spring Brook Water Co., none other being available.

2. *Mount Pleasant area,* a long strip running from the heart of the city northwest from the Lackawanna River and covering the area operated by the Mount Pleasant mine. To the north lies the Diamond mine of the Glen Alden Coal Co., on the west the Se-Rob mine and Hyde Park operations of the Glen Alden and a portion of the Oxford mines of the Peoples Coal Co. The Eight-Foot bed has been mined out and the space packed with rock. Under it are the Five-Foot, Four-Foot, Diamond, Rock, Big, New County and Clark beds and the three Dunmores, the Dunmores being under water. The report advocates the flushing of the Five-Foot, the Four-Foot and the Big beds, and these only under the area on which surface improvements have been made. To take care of the improved area down all the way to the Clark bed, 1,895,000 cu.yd. of backfilling would be needed, and 2,179,344 cu.yd. would be required to backfill all the excavations. Instead the report advocates backfilling only 1,895,000 cu.yd.

3. *Green-Ridge area,* lying to the northeast of the center of the city but on the same side of the Lackawanna River. This section embraces the Manville-Dickson colliery of the Green Ridge Coal Co. and workings of the Hudson Coal Co. adjacent to the Green Ridge workings but now idle. This area contains all the beds in the second, or Mount Pleasant, area.

David Lloyd has stated that the Green Ridge Coal Co. intends to flush the workings of the Clark bed in the Sanderson tract preparatory to or in conjunction with the mining of the pillars in this bed. For this reason, and because the Hudson Coal Co.'s workings are idle and much machinery would be necessary to backfill them, the flushing of this area is not recommended in the report. It can be left until time comes for removal of the coal.

To fill under the area which has been improved would require 1,771,448 cu.yd. and to fill it all, 28,667,129 cu.yd. The Big bed and the upper New County are missing over much of the area, due in some sectors to the lifting of the beds and their erosion, and in others to wants due to a heavy deposition of detritus during the formation of the New County bed, which split it into two parts and formed such high ground that some at least of the upper beds were never laid down at all in those sectors. Only in one small area are all the beds present.

4. *Central City and Hill area* to the east

Scranton showing outcrops of various coal seams and arbitrary divisions of area as set forth in McCormick report on backfilling of voids under city

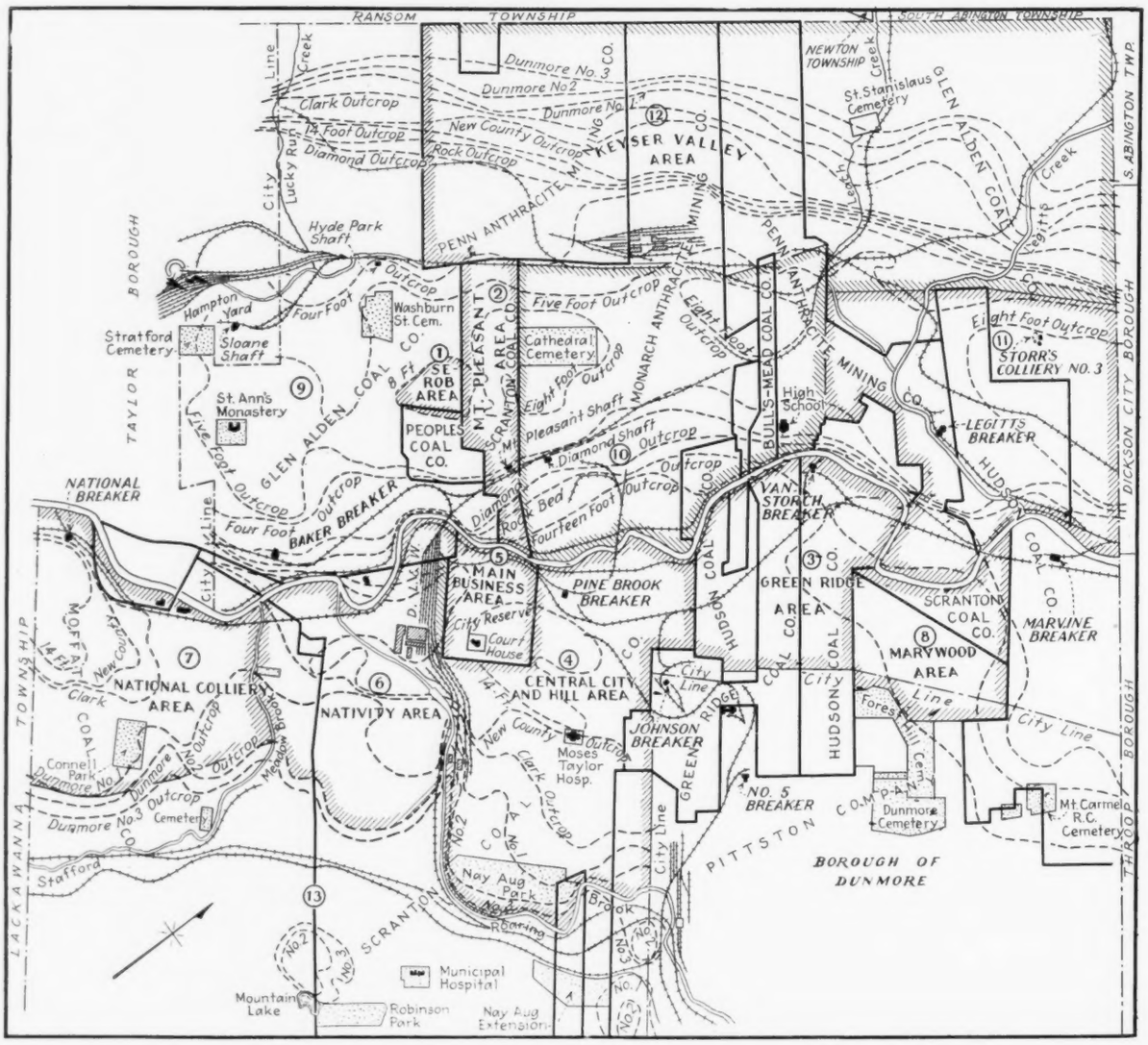


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Table I—Average Thickness of Coal Beds Under the Eight Areas Studied

Beds	Se-Rob Area (1)	Mt. Pleasant Area (2)	Green Ridge Area (3)	Central City Area (4)	Main Business Area (5)	South Side Area (6)	National Colliery Area (7)	Marywood Area (8)
Eight-Foot	5 ft. 6 in.	5 ft. 6 in.	.....	.....	.....	.....	.....	.....
Five-Foot	.....	5 ft. 8 in.	3 ft. 10 in.	.....	.....	.....	.....	.....
Four-Foot	.....	5 ft. 6 in.	3 ft. 4 in.	.....	.....	.....	.....	.....
Diamond	.....	8 ft. 6 in.	6 ft. 8 in.	.....	.....	.....	.....	.....
Rock	.....	8 ft. 0 in.	2 ft. 8 in.	.....	.....	.....	.....	.....
Big	.....	14 ft. 0 in.	9 ft. 6 in.	12 ft. 0 in.	12 ft. 0 in.	.....	14 ft. 0 in.	13 ft. 7 in.
Upper New County	.....	15 ft. 0 in.	.....	4 ft. 6 in.	4 ft. 6 in.	.....	.....	.....
Lower New County	.....	.....	4 ft. 0 in.	5 ft. 0 in.	3 ft. 6 in.	9 ft. 6 in.	5 ft. 5 in.	.....
Clark	.....	6 ft. 6 in.	6 ft. 0 in.	7 ft. 0 in.	7 ft. 0 in.	6 ft. 0 in.	3 ft. 8 in.	6 ft. 0 in.
Dunmore No. 1	.....	3 ft. 8 in.	3 ft. 3 in.	5 ft. 0 in.	5 ft. 0 in.	5 ft. 0 in.	.....	4 ft. 8 in.
Dunmore No. 2	.....	.....	3 ft. 3 in.	5 ft. 0 in.	5 ft. 0 in.	5 ft. 0 in.	3 ft. 5 in.	4 ft. 0 in.
Dunmore No. 3	.....	2 ft. 6 in.	3 ft. 6 in.	3 ft. 6 in.	3 ft. 6 in.	.....	.....	3 ft. 7 in.
	.....	64 ft. 10 in.	46 ft. 0 in.	42 ft. 0 in.	40 ft. 6 in.	25 ft. 6 in.	25 ft. 6 in.	31 ft. 0 in.

of the center of the city is underlaid by a portion of the workings of the Pine Brook colliery. The Scranton Coal Co., which owns this mine, has flushed some of the beds of the section. The report recommends that 1,000,000 cu.yd. of material be flushed into the spaces excavated in the Big, Upper and Lower New County and Clark beds. Water for this backfilling will be obtained by damming the outflow in the Dunmore No. 2 basin near the Laurel Line power house. This dam can be built without impeding mining or endangering the workings.

Water can be pumped from this point to various boreholes where the flushing feed will be introduced. Water from Dunmore No. 2 bed also can be supplemented by diverting it inside near the Central Hill section before it travels to the channels leading to Dunmore No. 2 waterway. To fill the entire extracted area, the surface over which is everywhere improved, would take 3,166,860 cu.yd., but only a little less than one-third of that quantity is to be provided.

5. *Main Business area* in the center of the city. This is underlaid by a portion of the workings of the Pine Brook colliery. The Scranton Coal Co. was unable for many years to pay its taxes, and finally in lieu of payment deeded the coal remaining to the city, which, however, had at that time a large reserve of its own. The company had already done much flushing and rock packing, but the report advocates the flushing of the workings in the Big bed and in the Upper and Lower New County beds with 700,000 cu.yd. and suggests that the city authorities form a central dump for ashes, and in the spring months screen these ashes and flush them into the areas as yet unfilled.

6. *South Side or Nativity area,* lying to the south of the center of the city. This area has New County, Clark and Dunmore Nos. 2 and 3; Dunmore No. 2 has one of the oldest workings in the region, having been worked in the early forties, when the coal was used in blast furnaces. A complete job would require 2,908,675 cu.yd., about half of which should be allocated to the lowest bed, which covers a large part of the area. However, only 825,000 cu.yd. is allocated, this to the Clark, New County and Dunmore No. 2 beds.

7. *National Colliery area,* which lies southwest of the preceding, or south side, area. Formerly undermined by the Connell Coal Co., it came into the hands of the Glen Alden Coal Co., where coal is now being extracted by the Moffat Coal Co., but, prior to the last transfer, part of the area was mined by the Gibbons Coal Co. In this area are the Big, Lower New County, Clark, and Dunmore Nos. 1 and 2. To fill up the voids 1,978,658 cu.yd. would be necessary, but only 75,000 cu.yd. is allotted. Blind flushing is necessary, as the workings in the Big and New County beds, which alone will be filled, cannot be entered.

8. *Marywood area,* northeast of the center of the city and on the same side of the Lackawanna River. This area contains a large number of institutional buildings. The Pittston Co. has for many years been flushing the Clark and Big beds in this area and is now flushing the Clark bed in the lower Green Ridge area, adjacent to the Scranton Coal Co.'s Pine Brook and Richmond workings. Though 1,438,273 cu.yd. has been removed, only 500,000 cu.yd. of filling is allocated to this section.

Five other areas are to be found in the confines of the city, but the report omits them, probably because there is no acute need for backfilling operations or because the workings are owned by companies still active. These sections are: (9) area west of city center and across the Lackawanna River where the coal is owned by the Glen Alden Coal Co.; (10) area between Keyser Valley car shops (Delaware, Lackawanna & Western R.R.) and Lackawanna River, and located over the coal lands being mined by the Monarch Anthracite Mining Co., and in lesser degree by those of the Penn Anthracite Mining Co. and the Bullshead Coal Co.; (11) area northeast of No. 10 and on the north side of the Lackawanna River comprising lands of the Penn Anthracite Mining Co. and the Hudson and Glen Alden coal companies adjacent to Dickson City Borough; (12) Keyser Valley area, a large but unurbanized area to the west with some coal owned by the Penn Anthracite Mining Co. and the Glen Alden Coal Co.; (13) an area on the east side between the city proper and Roaring Brook township.

The assessed valuation of the property overlying the mined section aggregates $62,950,000. Doubtless the actual value is much greater and, in the valuation, the worth of institutions, schools, churches, hospitals, county and municipal buildings—of which there are many—is not included. The valuation covers only a few of the thirteen areas, but it includes some of the most populous sectors and those having the most coal, for areas 12 and 13—especially 13—are largely in unproductive measures.

Out of 16,124,684 cu.yd. calculated as excavated and unflushed, 13,604,559 cu.yd. being needed to fill vacuities under improved land, the report advocates at present, the filling of only 4,516,000 cu.yd., about 28 per cent of the total.

According to the report, 300,000,000 tons has been excavated below the city of Scranton, which would be about 250,000,000 cu.yd., as against the 16 million odd estimated, to say nothing of 14,567,057 cu.yd. of waste material in dumps available for flushing, all of which—breaker refuse, ashes, rock, silt—came out of the ground, though the stripped material (338,325 cu.yd.) should be excluded, for its removal does not threaten the city with mine caves. Some of the area cannot be refilled and some may have clogged itself. The Conner-Griffith study, quoted by the author of this report, declared that one-half of the space which had been created by mining up to 1910 had probably closed itself.

Table II—Valuations of Scranton's Surface Improvements, Its Flushing Needs and Proposed Flushing

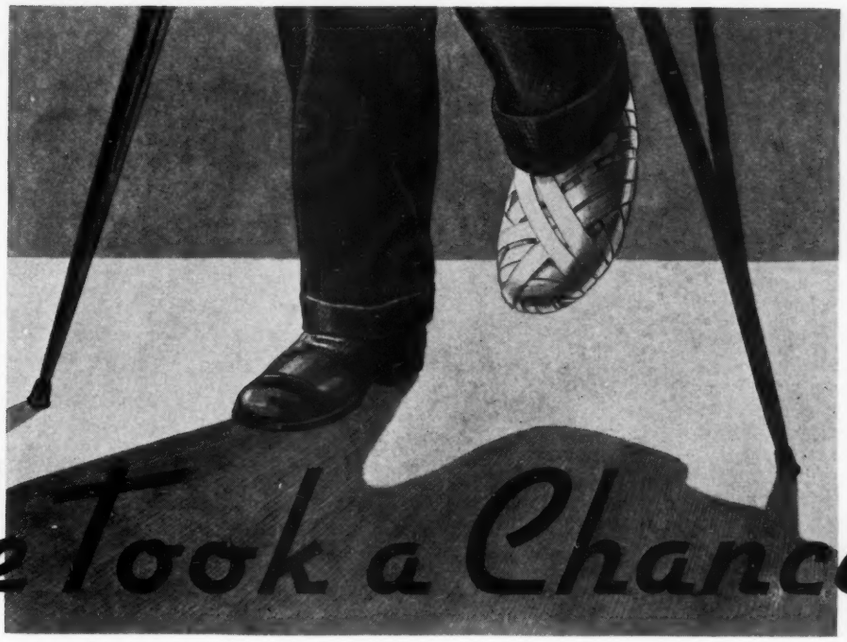
Tract No.	Area	Assessed Valuation of Overlying Mined Area	Cubic Yards of Flushing Required: Under Improved Land	Cubic Yards of Flushing Required: Under All Land	Flushing Suggested Cu. Yd.
1	Se-Rob	$700,000	175,000	175,000	175,000
2	Mt. Pleasant	2,250,000	1,895,000	2,179,344	1,241,000
3	Green Ridge	6,000,000	1,771,448	2,667,129	.....
4	Central City	17,000,000	3,166,860	3,166,860	1,000,000
5	Main Business	21,000,000	1,610,744	1,610,744	700,000
6	South Side	8,000,000	2,908,675	2,908,675	825,000
7	National Colliery	5,000,000	1,210,657	1,978,658	75,000
8	Marywood	3,000,000	886,175	1,438,274	500,000
		$62,950,000	13,604,559	16,124,684	4,516,000

New Preparation Facilities

ALDEN COAL CO., Alden Station, Pa., contract closed with the Wilmot Engineering Co. for additional preparation equipment consisting of Hydrotator classifier for desliming anthracite silt at the rate of 25 to 30 tons per hour; to be in operation late in September.

BROOKSIDE-PRATT MINING CO., Lindbergh mine, Blossburg, Ala.: contract closed with the Jeffrey Mfg. Co. for Jeffrey diaphragm jig with automatic fish-float controls, adjustable screen plates, cam drive for differential stroke and other special features to clean 3x½-in. coal; capacity, 60 tons per hour.

CARBON GLOW MINING CO., Carbon Glow, Ky.: contract closed with the American Coal Cleaning Corporation for American pneumatic coal-cleaning plant with a



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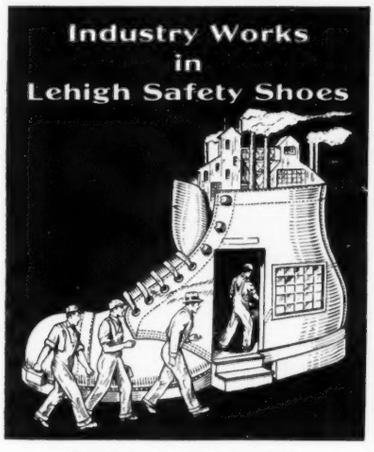
911—Black Elk Blucher, Leather Middle Sole, Grid Rubber Outsole and Rubber Heel, Brass Rivets in Shank. D 5-12, E 5-13, EEE 6-12

X-912—As above except two full Chrome Leather Soles and Heels. E 5-12

912—Same as X-912, except Rubber Heels. D 5-12, E 5-12, EEE 5-12.



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Company .....

Address .....

capacity of 75 tons of 2x0-in. raw feed per hour. Equipment includes: Type "Y" size RA-14½x6-ft. pneumatic separator, metallic dust-collecting system, and an American 4x10-ft. double-deck "Anti-Gravity" screen for separating cleaned coal into 2x1½-, 1½x¾- and ¾x0-in. sizes.

Chafin-Jones-Heatherman Coal Co., Peach Creek, W. Va.: Kanawha Mfg. Co. installing additional cleaning equipment obtained from American Coal Cleaning Corporation to handle ¾x¾-in. coal at the rate of 38 tons per hour. Equipment includes: one Type "Y" 5x10-ft. pneumatic separator with auxiliary equipment and one 6x12-ft. double-deck "Anti-Gravity" screen for separating 2x0-in. coal into 2x⅞-, ⅞x¾- and ¾x0-in. sizes at the rate of 125 tons per hour.

Douglas Coal Co., Fireco, W. Va.: contract closed with the American Coal Cleaning Corporation for Type "Y" Size RY-5x10-ft. American pneumatic separator and auxiliary equipment for cleaning 2x0-in. coal; capacity, 50 tons per hour.

Hickory Grove Coal Mining Co., Jasonville, Ind.: contract closed with the Jeffrey Mfg. Co. for drying-plant addition to Jeffrey tipple and washery now under construction. The plant will include centrifugal and heat-drying equipment arranged so that the coal may be centrifuged only or centrifuged and heat-dryed; capacity, 75 tons per hour.

Kemmerer-Gem Coal Co., St. Charles, Va.: contract closed with the Fairmont Machinery Co. for complete tipple equipped with shaker screens, three picking tables and loading booms, remixing conveyor, recirculating conveyor and two-stage crushing and rescreening conveyor; capacity, 250 tons per hour.

Laurel Smokeless Coal Co., Laurel Creek, W. Va.: contract closed with the American Coal Cleaning Corporation for American pneumatic coal-cleaning plant to handle 40 tons of 1¼x0-in. raw coal per hour. Equipment includes: one Type "Y" 5x10-ft. pneumatic separator with auxiliary equipment; to be installed by Sept. 15.

Maryland-New River Coal Co., Winona, W. Va.: contract closed with the Jeffrey Mfg. Co. for new three-track tipple and rescreening plant, including shaker screens, loading booms, Jeffrey-Traylor vibrating screens, and rescreens for producing the smaller sizes. Four sizes will be made in the tipple and three sizes in the rescreening plant. Tipple capacity is 200 tons per hour.

Perry Coal Co., St. Ellen mine, O'Fallon, Ill.: contract closed with the Jeffrey Mfg. Co. for complete washing-plant addition to present tipple, including one super-capacity Jeffrey Baum-type jig with complete circulating-water and fresh-water spray system, dewatering screens, settling tank with recovery conveyors for classified recovery of sludge, centrifugal drying equipment and conveyor assemblies for handling coal and refuse, including a Jeffrey multi-compartment mixing conveyor. Capacity of the installation, to handle 4x0-in. coal, is 400 tons per hour.

St. Louis Coal Co., Coulterville, Ill.: contract closed with the McNally-Pittsburg Mfg. Corporation for washing-plant addition to present preparation plant, including one McNally-Norton automatic washer to treat 2x0-in. coal, with provision for crushing pickings and running them to the washer to recover the coal; capacity, 100 tons per hour.

Lincoln welding award

Medal Design Approved

Approval has been given to the design of the Lincoln gold medal, accepted by the American Welding Society early this year, for presentation to the author of the best paper on any phase of welding published in the *Journal of the American Welding Society* between November, 1936, and October, 1937. Offered by J. F. Lincoln, president, Lincoln Electric Co., Cleveland, Ohio, as a stimulus to the preparation of worth-while contributions to the welding art, the medal is 2½ in. in diameter and will have engraved on the reverse side the name of the winner together with the date of presentation. Decision as to the best paper will rest with a committee consisting of Col. G. F. Jenks, K. V. King and F. E. Rogers and presentation will be made during the annual convention of the society, in October.

Combustion Course at W.V.U.

West Virginia University will hold the first training course in the nature of coal combustion ever held in the State at Morgantown on Sept. 29 and 30 under the auspices of the University School of Mines and the West Virginia Coal Mining Institute. The course will be held in conjunction with the annual meeting of the mining institute, will have for its purpose to explain to operators and employees the new problems in marketing brought about by enactment of the Bituminous Coal Act. It is hoped that the course will impart the information necessary to obtain and retain new markets for West Virginia coal in other parts of the country.

Operating and association officials are on the program to explain the main selling points of West Virginia coal and how it burns. Tests will be made and sample analyses undertaken during the sessions, besides which it is planned to demonstrate modern combustion methods and firing at the boilers of the university's heating plant.

At the opening session J. V. Sullivan, secretary, West Virginia Coal Association, will preside and the speakers will include W. E. Koepler, secretary, Pocahontas Operators' Association; W. W. Hodge, of the university School of Chemical Engineering, and Don Steele, Consolidation Co. C. A. Reed, director of engineering, National Coal Association, will preside in the afternoon, when the speakers will be: P. C. Thomas, vice-president, Koppers Coal Co.; D. T. Buckley, also of Koppers; W. A. Richards, president, Pemberton Coal & Coke Co., and Prof. W. A. Staab, of the university. The morning session of the second day will be presided over by J. H. Tobey, Appalachian Coals, Inc., with talks by C. J. Allen, Koppers Coal Co.; J. O. Smith, National Bituminous Coal Commission; E. C. Payne, Consolidation Coal Co., and Professor Hodge. S. C. Higgins, secretary, New River Operators' Association, will preside at the afternoon session; Prof. J. B. Grumbein, West Virginia University, will speak, and there will be an inspection tour of the university's boiler plant.

The course is an evolution of the fellowship in coal market research sponsored by the Upper Monongahela Valley Association, the Monongahela Valley Coal Mining Institute and the Monongahela System. On Oct. 1 the mining institute will hold its sessions, terminating with a banquet at the Morgan Hotel. There will be incidental trips to various mines in the vicinity.

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SMALL STOKER SALES SOAR

Sales of mechanical stokers in June last totaled 8,717 units, according to statistics furnished the U. S. Bureau of the Census by 108 manufacturers (Class 1, 62; Class 2, 29; Class 3, 35; Class 4, 32; Class 5, 13). This compares with sales of 6,782 units in the preceding month and 4,956 in June, 1936. Sales by classes in June last were: residential (under 61 lb. of coal per hour), 7,813 (bituminous, 7,199; anthracite, 614); small apartment-house and small commercial heating jobs (61 to 100 lb. per hour), 380; apartment-house and general small commercial heating jobs (101 to 300 lb. per hour), 289; large commercial and small high-pressure industrial steam plants (301 to 1,200 lb. per hour), 165; high-pressure industrial steam plants (over 1,200 lb. per hour), 70.

Renew Drive on Bootleg Coal

An ordinance designed to put an end to the flow of bootleg coal into New York City becomes effective on Aug. 27, having been signed by Mayor LaGuardia on July 28. The measure was strongly supported by Roderick Stephens, coordinator of the retail fuel industry, who said that, in signing the ordinance, which controls the sale of coal and coke in the greater city, the Mayor "has taken the most important step in recent years for the protection of coal consumers and responsible dealers. Organized labor also should be grateful because the ordinance goes a long way in protecting the standard of wages, hours and conditions it has taken many years to set up."

A drive against bootleg coal traffic was launched in New Jersey on Aug. 4, when thirteen drivers of coal trucks were arrested and committed to the Warren County jail at Belvidere and seven were arrested at Camden. The arrests were made by officers enforcing the recently enacted law against outlaw coal shipments. The law requires drivers to produce slips showing the origin or purchase of the coal, the quantity on each truck, and to whom consigned. The

SHOOTING THE SUN

REPUBLIC keeps its eyes on the future. Its chemists and engineers are always busy with new experiments, testing new ideas for improvement in belting, hose and other mechanical rubber products. They seek better rubber compounds, better reenforcing fabrics, better methods to increase service life and produce greater values.

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drivers arrested in Warren County drew sentences of 60 days when they were unable to pay fines of $100 and costs. Those taken into custody at Camden were released for later hearings.

Governor Earle of Pennsylvania is at work on a new plan to halt bootleg mining and cure other ills of the anthracite industry. In an effort to harmonize varying angles, he has called a conference of hard-coal interests to be held in Harrisburg, Pa., on Sept. 27. At that time he is to have W. Jett Lauck, chairman of the commission of five named last February, and Dr. James W. Angell, economist and also a member of the commission, meet with anthracite leaders and outline a policy they have advocated along with his own plans for putting into effect some arrangement that would put back to work all the legitimate miners who have been thrown out of work by improvements in mining.

Eighteen coal holes worked by independent workers on property of the Philadelphia & Reading Coal & Iron Co. near Pottsville, Pa., have been closed by State police in charge of Mining Inspector James Grace. Miners who worked the holes looked on as the officers dynamited them on Aug. 13. The holes had been sunk in barrier pillars left standing to protect the workings from fire and flood.

Anthracite for Arctic Posts

Destined to supply heat for the various Hudson Bay Co.'s posts during the long winters in the far north, approximately 125 tons of Pennsylvania anthracite is now en route to the Arctic in the hold of the steamship "Nascopie." The fuel not only supplies the heat necessary to maintain life in the sub-zero temperatures but also provides the means of melting ice and snow for drinking water.

Delivery of the fuel when the ship reaches the far north is a serious problem, as docking facilities are available at few points of call. Consequently such commodities are transferred to small boats, rowed to shore and transported overland by dog teams or on the backs of carriers. For convenience it is packed in sealed burlap bags holding 100 lb.

Stresses Economy of Heating With Bituminous Coal

"Heat With Bituminous Coal, the Modern, Economical Way," is the title of an informative booklet issued by the National Coal Association and the Stoker Manufacturers' Association, Chicago, a national organization of automatic coal-burner and stoker manufacturers. Appalachian Coals, Inc., marketing agency for high-volatile coals produced in eastern Kentucky, eastern Tennessee, southwestern Virginia and southern West Virginia, is distributing the booklet to its retail coal-merchant customers.

The booklet is published as part of a nation-wide campaign to acquaint home owners, and prospective ones, with just a few of the recent scientific developments in the preparation, distribution and use of bituminous coal. "It is a message of greater comfort and lasting economy," the foreword states. "It tells the story of progress, and of changes that have made coal heat the modern, economical way to heat your home."

Home builders are cautioned to "take nothing for granted." The booklet urges them to "investigate all fuels and all types of heating equipment." Finally, the coal and stoker industries say, "Talk with other home owners, with contractor-builders, residential architects, heating contractors, fuel dealers. Find out what your heating plant will cost and how much your fuel will cost."

Listing "five major points to consider," the booklet concludes by stressing the "convenience, economy, dependability, cleanliness and health" of coal heat.

Pact Lifts Tax on Soviet Coal

A new commercial agreement between the United States and the Soviet Union announced on Aug. 6 by the State Department at Washington lifts the tax of $2 per ton on Russian anthracite imported into this country. By the terms of the new pact the Soviet Union agrees to increase her guaranteed purchases from the United States to $40,000,000 in the next twelve months. The agreement renews and extends the commercial accord of the last two years between the two countries and orders most-favored-nation treatment on exports and imports between the two nations. Russia states, however, that her exports of coal to this country in the next twelve months will not exceed 400,000 tons.

Announcement of the new accord provoked a storm of protest from business, labor and political leaders in the anthracite region of Pennsylvania. But Secretary of State Cordell Hull characterized this as propaganda. Furthermore, he said that the Pennsylvania anthracite industry actually would benefit from the treaty. He pointed out, incidentally, that the 400,000-ton limit set is less than the actual imports of Russian coal in previous years—1936, for instance.

Eskimo women carrying Pennsylvania anthracite to provide heat and water supply in the Arctic

Iowa Gets New Mine

An eventual output of 500 tons per day is the goal of a new operation in Marion County, Iowa, eight miles southeast of Knoxville, opened by the Ramsey-Dooms Coal Co. The coal lies 76½ ft. deep and is reached by a two-compartment shaft with an electric hoist. Production at present is 200 tons per day, and the operation is equipped to ship exclusively by truck stoker, steam, range, nut and lump coal. Officers of the new company are: president, Roy Ramsey, Des Moines; vice-president, Andrew Dooms, Knoxville; and secretary-treasurer, Robert Ramsey, Des Moines. All are veteran Iowa mining men.

Industrial Notes

American Engineering Co., Philadelphia, Pa., has appointed the Sabin Engineering Co., Euclid Sixty-first Building, Cleveland, Ohio, as representative for the sale of Lo-Hed hoists.

Foote Bros. Gear & Machine Corporation has appointed Eugene D. Wilson, 703 Columbia Mutual Tower, Memphis, Tenn., as district representative.

Caterpillar Tractor Co. announces that Paul Weeks, who was manager of the Washington (D. C.) office until his transfer to the Peoria (Ill.) office about two years ago, returns to the capital post, relieving E. B. English, who will become manager of federal and State sales at Peoria. H. H. Howard, who has been with the company since 1926 in export and domestic sales capacities, has been appointed manager of the engine sales division.

Sullivan Machinery Co., Claremont, N. H., has appointed Gail E. Spain as general manager of its rock-handling division. Formerly assistant sales manager of Caterpillar Tractor Co., Mr. Spain will be in direct charge of domestic sales offices handling rock drills, portable air compressors, mining and industrial hoists, and in addition will be responsible for manufacturing and engineering activities of the division.

Lincoln Electric Co. has appointed Walter Dougan Wood, Jr., to the sales staff of its Philadelphia (Pa.) office. He

will handle arc-welding supply and engineering service.

CHAPMAN VALUE MANUFACTURING CO. announces that John J. Duggan, who for the last twenty years has been treasurer of the company, has been made president, and Frederic C. Low, formerly cost accountant and office manager, succeeds Mr. Duggan as treasurer.

New Research Plant Opened

On the foundations of an ancient grist mill near Westport, Conn., dating from shortly after the Revolutionary War, the new research laboratories and test plant of the Dorr Co. of New York were officially opened on July 30 in the presence of about two hundred members of various branches of the engineering profession. The plant is two miles from the center of Westport on a mill pond formed by the damming of the Saugatuck and Aspetuck rivers at their point of union. Fifty acres of wooded and farm land has been acquired and the entire research staff live within a mile or two of the mill. Arrangements within the building are adapted to present research needs. The analytical laboratory has accommodations for several analysts, and the research laboratories are separated so as to isolate the work on different projects.

To Cooperate in Statistics

A cooperative agreement to collect statistics of coal consumption was announced on Aug. 2 by the National Bituminous Coal Commission and the National Association of Purchasing Agents. As the representative of organized industrial consumers, the association will aid the Commission in the compilation of monthly reports of stocks on hand and current requirements of general manufacturing industries. Individual reports will be held strictly confidential, but the totals, obtained from thousands of representative correspondents, will give an up-to-the-minute barometer of the demand side of the market and will be of service both to buyers and sellers of coal. Cooperation from other consumer groups is assured to make the monthly survey complete.

The agreement follows the lines of a similar arrangement previously in effect between the association and the U. S. Bureau of Mines. It is found to improve the accuracy of the statistics, reduce the cost to the government, and avoid burdening industry with overlapping questionnaires.

Financial Reports

Hatfield-Campbell Creek Coal Co.—Net profit for six months ended June 30, $11,905 before federal taxes, compared with net loss of $71,200 for the corresponding period of last year.

Island Creek Coal Co. and subsidiaries—Net profit for three months ended June 30, $213,487, compared with net profit of $183,405 in June quarter of 1936.

Pennsylvania Coal & Coke Corporation—Loss for three months ended June 30, $125,922 including income from allied companies operated under Clearfield Bituminous Coal Corporation lease but before federal income taxes. This compares with a profit of $1,229 in the preceding quarter and $71,805 loss in June quarter a year ago.

Pittsburgh Coal Co. and subsidiaries—Net loss for three months ended June 30, $370,046, compared with $735,604 loss in second quarter of 1936.

Pittsburgh Terminal Coal Corporation and subsidiaries—Net loss for six months ended June 30, $162,091, compared with $274,838 loss in first half of 1936.

Pittston Co.—Net loss for six months ended June 30, $1,191,438, compared with net loss of $581,328 in first half of 1936.

Pond Creek Pocahontas Co.—Net loss for three months ended June 30, $10,406, compared with loss of $4,585 in the corresponding period of 1936.

Virginia Iron, Coal & Coke Co.—Net loss for six months ended June 30, $62,833, against $81,955 loss in first half of 1936.

PERMISSIBLE PLATES ISSUED

FOUR approvals of permissible equipment were issued by the U. S. Bureau of Mines in July, as follows:

Joy Manufacturing Co.: Type U-179-14 chain conveyor; 15-hp. motor, 230 volts, d.c.; Approval 321; July 1.

Goodman Manufacturing Co.: Type 724-DJ slabbing machine; 70-hp. motor, 250 volts, d.c.; Approval 322; July 9.

La-Del Conveyor & Manufacturing Co.: Model FA room conveyor; 10-hp. motor, 230 volts, d.c.; Approval 323; July 19.

La-Del Conveyor & Manufacturing Co.: Model FF face conveyor; 5-hp. motor, 230 volts, d.c.; Approval 324; July 31.

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Obituary

JOHN W. PRICE, 50, superintendent of the Hazleton Shaft colliery of the Lehigh Valley Coal Co., Hazleton, Pa., died suddenly July 27 from a heart attack. He was found dead in his automobile after his return from assisting in fighting a fire in the Spring Mountain mine of the company.

DR. HENRY STURGIS DRINKER, 87, president emeritus of Lehigh University, South Bethlehem, Pa., died July 27 of a heart attack at his summer home, at Beach Haven, N. J. Born in Hong Kong, China, he was graduated from Lehigh as a mining engineer, was employed by the Lehigh Valley Railroad Co. as a mine clerk and steadily rose to a position of importance in the mining industry. He was president of Lehigh from 1905 to 1920.

JAMES L. LIBBY, 52, assistant chief engineer, Union Pacific Coal Co., died July 30 at his home in Rock Springs, Wyo., following an illness of nearly eight months. Born in Cheyenne and educated at the Colorado School of Mines, Mr. Libby had been with the Union Pacific company for eleven years. He had formerly been with the Lion Coal Co., Ogden, Utah.

Wood Seals Blamed in Blast

The explosion in the Baker mine of the Glendora Coal Co., near Sullivan, Ind., on July 15, in which twenty miners were killed, resulted directly from the blowing out of wood seals placed in two abandoned entries adjacent to where the victims had started working, according to a report by Coroner Cecil B. Taylor. The report, issued on July 21, says further that the temporary seals were placed the day preceding the disaster and that sudden concussion of air was caused by a large fall of the roof in an abandoned working temporarily sealed, the gas being in some manner ignited when forced into the area where the men died.

Mine Fatality Rate Climbs

Coal-mine accidents caused the deaths of 78 bituminous and 25 anthracite miners in June last, according to reports furnished the U. S. Bureau of Mines by State mine inspectors. With a production of 31,560,000 tons, the bituminous death rate in June was 2.47 per million tons, compared with 2.30 in the preceding month and 2.21 in June of last year. The anthracite fatality rate in June last was 5.59, based on an output of 4,475,000 tons, as against 3.80 in the preceding month and 6.04 in June, 1936. For the two industries combined, the death rate in June last was 2.86, compared with 2.49 in the preceding month and 2.43 in June, 1936.

Comparative fatality rates for the first six months of 1936 and 1937, by causes, are given in the following table:

FATALITIES AND DEATH RATES AT UNITED STATES COAL MINES BY CAUSES*

January–June, 1936 and 1937

	Bituminous				Anthracite				Total			
	Number killed		Killed per million tons		Number killed		Killed per million tons		Number killed		Killed per million tons	
Cause												
Falls of roof and coal	291	260	1.449	1.172	75	72	2.537	2.610	366	332	1.589	1.331
Haulage	75	110	.373	.496	9	17	.304	.616	84	127	.365	.509
Gas or dust explosions:												
Local explosions	8	8	.040	.036	11	....	.372	.....	19	8	.082	.032
Major explosions	8	27	.040	.122	....	....	.....	.....	8	27	.035	.108
Explosives	15	16	.074	.072	10	8	.338	.290	25	24	.108	.096
Electricity	12	26	.060	.117	5	2	.169	.073	17	28	.074	.112
Mining machines	8	9	.040	.040	....	....	.....	.....	8	9	.035	.036
Other machinery	5	3	.025	.013	2	1	.068	.036	7	4	.030	.016
Miscellaneous:												
Minor accidents	14	13	.070	.059	14	6	.474	.217	28	19	.122	.076
Major accidents	....	....	....	....	....	....	.....	.....	....	....	.....	.....
Shaft:												
Minor accidents	3	10	.015	.045	6	1	.203	.036	9	11	.039	.044
Major accidents	....	....	....	....	....	....	.....	.....	....	....	.....	.....
Stripping or open-cut	6	4	.030	.018	4	5	.135	.181	10	9	.043	.036
Surface	14	33	.070	.149	10	11	.338	.399	24	44	.104	.177
Total	459	519	2.286	2.339	146	123	4.938	4.458	605	642	2.626	2.573

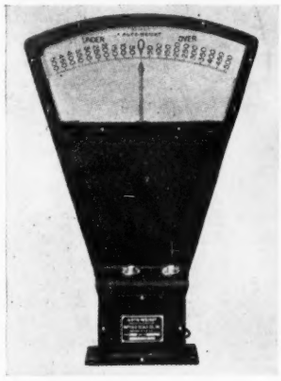
* All figures subject to revision

WHAT'S NEW

In Coal-Mining Equipment

SCALE INDICATOR

Buffalo Scale Co., Inc., Buffalo, N. Y., offers the new Buffalo "Auto-Weight" indicator for use on beam scales. This unit, according to the company, adds the advantages of dial visibility, speed and weighing convenience and at the same time retains the sureness and proved dependability of beam-scale weighing. The "Auto-Weight" is designed for use with any beam-type truck, wagon, stock, miner, dormant or track scale. It is available in two styles: "over-and-under," for use in weighing where loads are trimmed to exact weights, and "gross-load." The latter has a chart graduated in standard increments and takes the place of the unit poise. The weighman handles only the large poise and then adds the poundage indicated by the "Auto-Weight" pointer.



COUPLING

An improved design of flexible coupling is offered by the Falk Corporation, Milwaukee, Wis., under the trade name "Steelflex." This design, according to the company, uses the basic principle of shock absorption and compensation for misalignment through the action of a resilient grid member employed in previous Falk units, with improvements through the use of a symmetrical design applying to both the driving and driven hubs and the halves of the coupling cover, the latter protecting the operating elements and acting as a grease reservoir. Openings between the shell and the coupling hubs are sealed with molded "Neoprene." The FA-Type "Steelflex" coupling is available in sizes from 0.4 to 18,000 hp.

HAULAGE AIDS

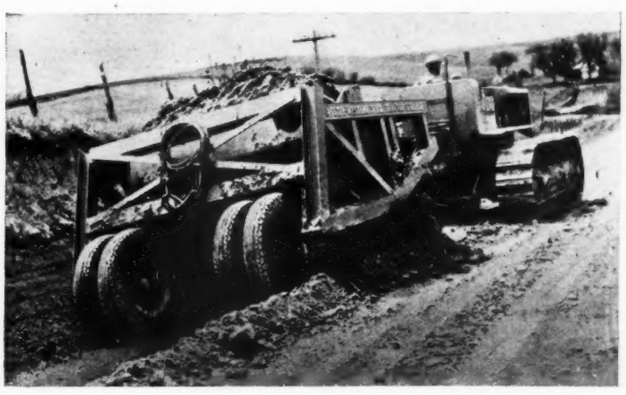
C. S. Card Iron Works Co., Denver, Colo., offers Card "Molychro" semi-steel heat-treated wheels for mines where severe haulage conditions are encountered or where a better wheel is desired. In the manufacture of this wheel, the company points out, molybdenum and chrome are added to the tested semi-steel wheel metal, giving increased tensile strength, transverse strength, impact strength, fatigue strength, hardness without too great sacrifice of machinability, resistance to abrasion and metal "density."

Strength, few working parts and reduced space for installation and operation are features cited for the new Card parallel-ground-throw switch stand, which is built of steel with the exception of the cast-iron lever weight. All bearings and working parts are machine finished. Throw is adjustable from 3 to 4 in. through the screw crank. Height of the largest size is 4 in. over the ties. An adjustable end is provided on the plain steel connecting rod, giving a second point for switch adjustment. Principal working parts are covered and protected by a steel plate top.

Card also offers a new Timken-roller-bearing skip truck with semi-steel heat-treated wheels, said to be an easy-running unit eliminating many of the difficulties encountered in skip-truck design. Bearings are grease lubricated and are protected against the entrance of dirt. Axles are made of a special-analysis steel, and are available in both square and round types. Rear wheels with a straight, wide tread or with the skip-ring tread a different-from-standard diameter or width are available, along with wheels with a flange 1¼ in. high.

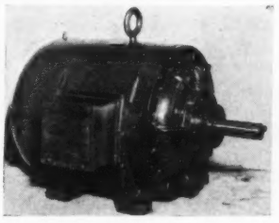
TRACTOR SCRAPER

Characterized as loading with still greater ease and speed, thus surpassing the performance of the unit it replaces, a new 5-cu.yd. tractor scraper is offered by the Austin-Western Road Machinery Co., Aurora, Ill. Like its predecessor, the new scraper uses but one rope and one lever to control all loading, carrying and dumping functions, and is designed to work with any tractor having a horsepower ranging from 35 to 60. Adjustments have been provided for varying the clearance under the machine, and the front door is constructed so that the pan always will get a full load, according to the company. Capacities up to 60 cu.yd. of pay dirt per hour are reported, the maker states.



MOTORS

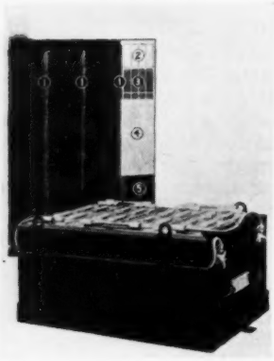
For use where service is severe, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., offers a new design of dual-ventilated fan-cooled Type CS squirrel-cage motor, said to be protected against abrasive dust, moisture and corrosion. These motors may be used outdoors without additional protection. The heat-exchanger principle of cooling is employed, using an internal fan on the rotor. The housing is designed so that fresh grease enters the outside edge at the top of the bearing, while excess or used grease is discharged at the bottom inner edge to the overflow sump, thus automatically cleaning the bearing, it is stated.



Westinghouse also offers new low-cost detachable instruments whose sockets may be cut into the conduit run feeding a motor or may be grouped in standard metal boxes to constitute a panel assembly. These instruments consist of two main units—a socket or mounting device with electrical connection jaws and the instrument mechanism, which is mounted on a plate with electrical connection blades on the back and is inclosed in a weatherproof glass housing. The socket is available with either two or three threaded outlets to receive ¾-, 1- and 1¼-in. pipe conduits, and with breakouts in the back for certain wiring arrangements. Standard sockets are available in a wide variety of styles. Instruments include ammeters, voltmeters and wattmeters.

BATTERY

The new "USL Durapak" storage battery for locomotive service is offered by the USL Battery Corporation, Niagara Falls, N. Y. The new battery is characterized by a new positive plate said to have the following advantages: (1) patented "sectional" construction for withstanding stresses growing out of expansion and contraction; (2) heavy one-piece interlocking grid plate for greater mechanical strength and conductivity; (3) machine-pasted plates for greater uniformity; (4) glass-fiber retainer pads to prevent loss of plate material; and (5) special plate shielding to hold the glass-fiber retainer



pads permanently against the plate surface and at the same time permanently shield the entire plate. Other battery features cited by the company include: long-life "Permatex" all-rubber separators to balance the long service life of the positive plates, and improved negative plates with tapered tops and insulated edges for extra protection against short circuits.

FEEDER

The new "Utah" electro-magnetic feeders and conveyors for handling any dry or moist material ordinarily handled and delivering it at a uniform rate are offered by the Allis-Chalmers Mfg. Co., Milwaukee, Wis. Features include low power consumption and instantaneous and positive control of the feeding rate by means of tap changing with an auto-transformer dial.

COMPRESSORS

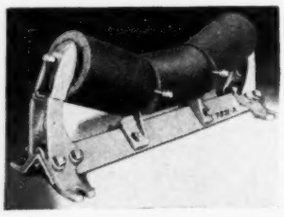
Sullivan Machinery Co., Michigan City, Ind., offers the new Class WN-112 air or gas compressors in displacement sizes of 378, 480, 642 and 800 c.f.m. Greater economy in power, maintenance, investment, installation and space is claimed. The unit is described as a continuous heavy-duty machine which, while built for any type of drive, reaches its greatest efficiency with the built-in motor. Thus equipped, it requires only 6x8 ft. of floor space in any of the above capacities. The unit includes the newly perfected Sullivan "Dual-Cushion" valves.

CAULKING COMPOUND

For waterproofing buildings, Truscon Laboratories, Detroit, Mich., offers a new caulking compound for which exceptional life and resiliency are claimed. The compound, it is stated, surface dries only and remains soft and rubbery underneath for years; consequently, it will not crack or shrink away from the walls of openings. It is recommended by the makers for pointing mortar joints, filling cracks in stone, concrete or stucco, and for flashing around parapet walls, chimneys, skylights and similar openings. It may be painted over, if desired.

BELT CARRIER

Stephens-Adamson Mfg. Co., Aurora, Ill., offers the new solid-rubber-roll "Impact" belt carrier. This carrier, it is pointed out, is distinguished by a heavy 1⅞-in. covering of vulcanized rubber extending entirely around the 2¼-in.-diameter pressed-steel hub of the roller, with the bottom layer of the roll vulcanized to the steel hub. The solid roll is formed of numerous layers of rubber wound about the hub, each layer vulcanized to the other. Primary applications are under loading points, in belt feeders, under the entire length of shuttle conveyors, or at any point where material is received. The cushioning effect is said to add substantially to belt life. Normal and heavy-duty types are available and the carrier is tilted to train the belt without guide rollers. The three 6-in. rollers form a 20-deg. trough. The "Impact" carrier also is available for flat belts.



BEARINGS

Fafnir Bearing Co., New Britain, Conn., now offers three distinct types of self-aligning ball bearings in a full range of sizes, making available a self-aligning construction to meet every normal requirement wherever this style of bearing is necessary. In the "B"-type bearing, the conventional outer ring is made with its outside surface spherical instead of cylindrical. A concave inner surface in the housing, which corresponds to the convex outer surface of the ring, permits the bearing to swivel into true alignment with the shaft.

The "S"-type bearing, it is said, permits the conventional cylindrical inner surface of the housing to be retained by providing an extra self-aligning ring with a concave inner surface. This extra ring surrounds the spherically ground outer bearing ring proper to form the alignment socket. Advantages claimed are: Requires only simple straight-bore housing; easy mounting similar to ordinary radial bearing; and ring-to-ring contact with no movement against the housing.

The "L"-type bearing gives alignment entirely from within the outer bearing ring, according to the company, permitting the housing to be both straight bored and of minimum diameter. A double row of balls is used, even in single-row-width bearings. The two rows of balls, tracked by two races on the inner ring, are left free to locate themselves in one spherical race on the outer ring. Here the balls themselves roll the inner ring and shaft into alignment.

These self-aligning bearings are available in single- and double-row and wide-inner-ring types.

ELEVATOR BUCKET

Link-Belt Co., Chicago, announces the improved "Super Salem" steel elevator bucket, now reinforced at the digging lip, front corners and along the back. Additional strength and greater resistance to abrasive wear and distortion without increased weight are claimed. No rivets are employed and it is unnecessary to use washers on the bucket-attachment bolts, as the entire back of the reinforcing plate is a smooth, flat surface. "Super Salem" buckets,

made in 2½x2½-in. to 30x8-in. sizes, are interchangeable with the old and in the 24- and 18-gage types are said to be comparable to the "heavy" construction of the conventional standard Salem design. The new bucket also is available in copper, brass, aluminum, Monel metal or stainless steel.

INCLOSED MOTOR

Wagner Electric Corporation, St. Louis, Mo., offers a new line of Type CP totally inclosed fan-cooled motors for use in atmospheres containing abrasive, explosive or corrosive dusts or gases, and for extremely damp outdoor applications. The motor consists of a skeleton-type stator deeply grooved on the outside to increase radiation, and is provided with totally inclosed ball-bearing end plates with long machined fits to seal completely the working parts of the unit. Cooling air is supplied by an external blower mounted on the front end.

EXCAVATOR

To fill a demand for large excavators with higher operating speeds, Harnischfeger Corporation, Milwaukee, Wis., offers the high-speed fully convertible P&H Model 955 shovel with a capacity of 2½ cu.yd. Arc-welded construction, it is stated, has eliminated tons of deadweight

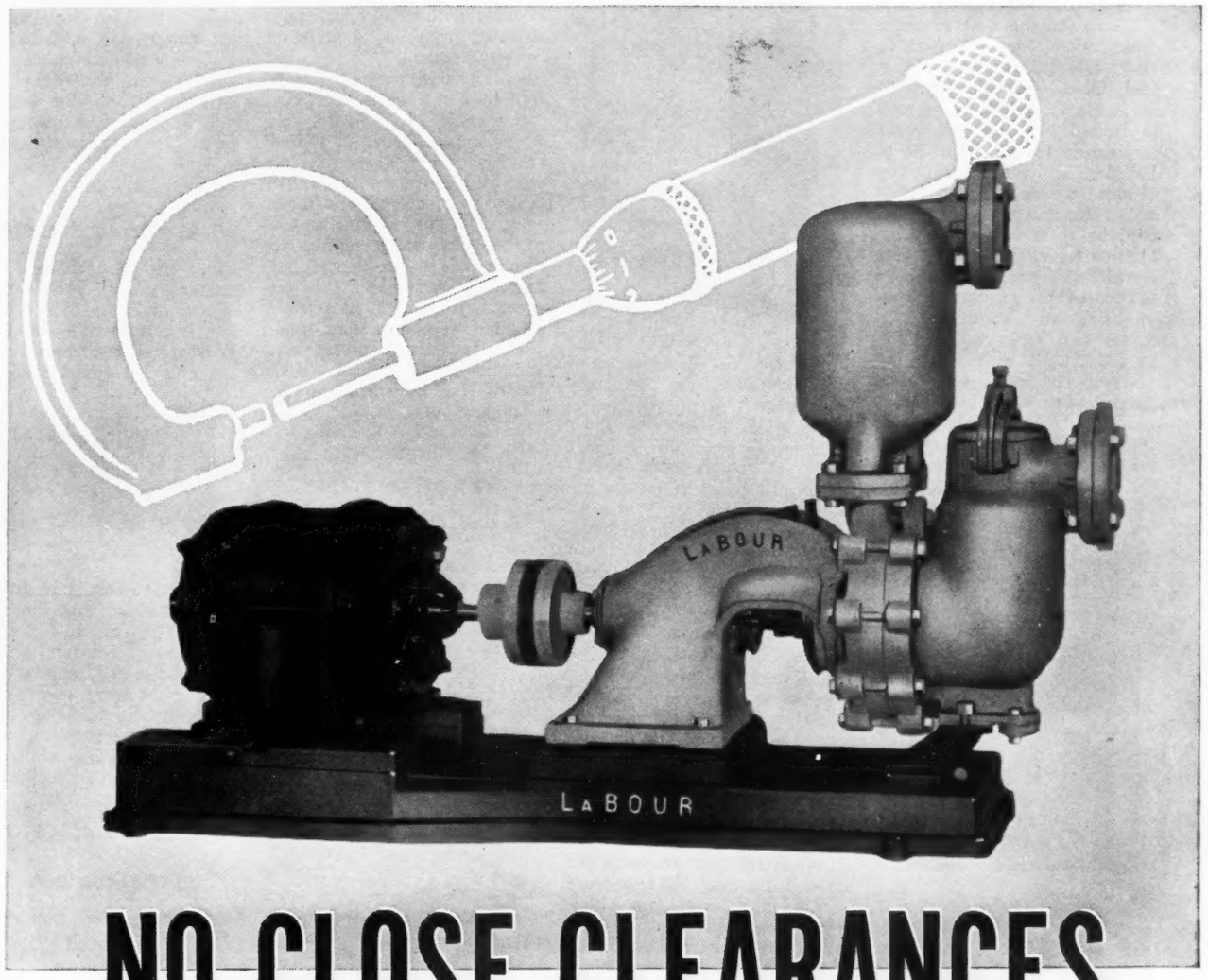
and made possible faster swing and stop with less wear and tear. Heavy-duty roller bearings are used wherever they will add to efficiency. As a dragline, the 955 is said to assure an exceptionally large daily yardage over wider clean-up areas. Equipped with long crawlers with 36-in. shoes—wider, if necessary—provision has been made for an easy changeover to longer "cats" to further reduce pressure on exceptionally soggy ground. The unit is powered by an 8-cylinder Fairbanks-Morse diesel engine.

BEARING LAYOUTS

New Departure Division, General Motors Corporation, Bristol, Conn., offers a set of nineteen sheets of full-sized drawings of ball bearings for layout work, which can be secured free on application. Single-row, double-row, "Radex," duplex and self-sealed bearings are included.

PORTABLE HAMMERS

Barco Mfg. Co., Chicago, offers two new portable gasoline hammers changed to incorporate a new timing device and a rearranged bottom end. The H-6 heavy-duty unit, with a weight of 89 lb., is offered for pavement breaking, shallow drilling, backfill tamping, asphalt cutting, sheeting driving and general demolition work. The small Model J-2 unit has been developed for continuous drilling, and with it there is available a complete set-up, including a small portable compressor to facilitate use in hard-to-get-at locations.



NO CLOSE CLEARANCES

■ The efficiency of LaBour Pumps is not dependent on maintaining micrometer-close clearances between casing and impeller. There are no sealing rings or close fitting parts (excepting, of course, bearings). Hence, even excessive wear does not seriously affect the capacity or effectiveness of LaBour Pumps — does not materially reduce the priming speed or ability of self-priming types.

This fact, of course, accounts in part for the remarkably long service life reported by owners of LaBour Pumps in all branches of the process industries. It reduces power requirements, too, for the friction of moving surfaces is eliminated.

Special types of LaBour Pumps are built for thin vein work, and any mine water corrosive problem can be met with suitable alloys. Details may be had for the asking.

LABOUR PUMPS

THE LABOUR COMPANY, INC.
ELKHART, INDIANA

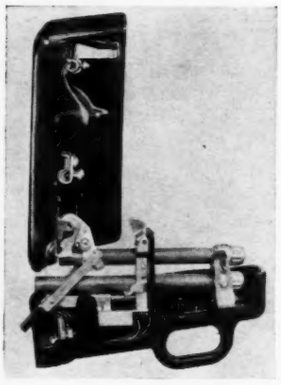
ANGLE CLAMP

To reduce the cost of angle construction on distribution lines, Ohio Brass Co., Mansfield, Ohio, offers an improved angle clamp stated to be easy to install and also to permit turning angles of from 30 to 120 deg. without the necessity of dead-ending the conductors and using jumpers. No parts need be removed for attaching the conductor. The keeper piece is reversible and has two sizes of conductor grooves accommodating all commercial conductor sizes from No. 6 AWG to 2/0 ACSR with armor rod (0.18 to 0.60 in.). Clamp-seat curve radius is 3 in., said to meet the requirements of any copper, aluminum and steel conductor in the indicated range.

The clamp can be attached to an eye, clevis or hook-type suspension insulator without any intermediate fitting, and is stated to have ample strength for conductor tensions in excess of 5,000 lb., even under full ice, wind and temperature loadings.

FIREPROOF CABLE; FUSE CUTOUT

General Electric Co., Schenectady, N. Y., announces the new "Flamenol" synthetic insulating compound, which it describes as similar to rubber without containing any of that substance. It will not support combustion and also is said to be highly resistant to moisture, acids, alkalis and oils, in addition to having excellent ageing characteristics and high mechanical strength. Properties are such that it can be made a very soft and flexible compound or one with celluloid-like rigidity. It can be put into solution for coating and impregnating, and can be compounded, filled, calendered and extruded in much the same way as rubber. "Flamenol-insulated" cable is recommended by the company for power and control circuits of 600 volts and less with a maximum copper temperature

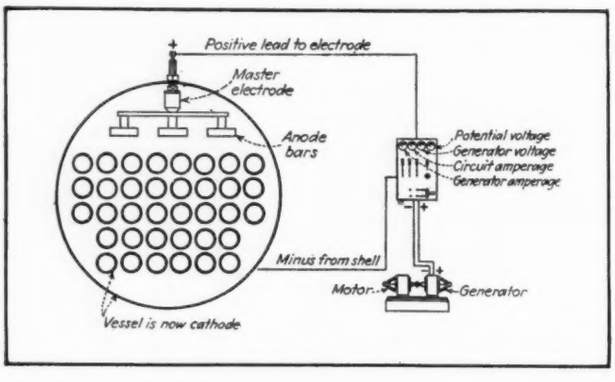


of 60 deg. C. Braid, lead or armor finishes are necessary only when extreme mechanical abuse is expected.

A new and radically different fuse cutout—porcelain housed with reclosing features—is another General Electric product. The reclosing mechanism is entirely in the door, which is constructed so that it is interchangeable with the door of the present G. E. 50-amp. indicating and drop-out cutouts, making it possible to convert the latter into reclosing units by adding the new door. The reclosing door of the new cutout contains two fuse holders. Should the first fuse link blow, the door is pushed out at the bottom—a positive indication. After a one-second delay the other fuse holder with its link is connected, thus restoring service if the fault is temporary. Should the second fuse blow, the complete door drops open and is isolated from the circuit. The new cutout is available in the 50-amp. rating for 5,000 volts and for 7,500/12,500 GR Y volts. Also, the door with the reclosing mechanism is available as a separate item.

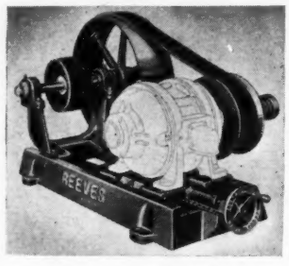
CORROSION-PREVENTING SYSTEM

Electrolytic Metal Protection, Inc., New York City, offers the Kirkaldy System of electrolytic metal protection for prevention of scale and corrosion in steam-plant equipment and similar services. In this system, suitable anodic bars, or disks, are mounted within but electrically insulated from the power-plant units (boilers, condensers, pumps, heaters, pipe lines, etc.). By means of a weak direct current supplied by a motor-generator and controlled at a small switchboard, the power-plant units are converted from their normally anodic to a cathodic state, with the result that corrosion and scale formation are transferred to the anodic bars especially installed for this purpose. From 5 to 10 volts is required, depending upon conditions, and after current consumption is determined and the controller is adjusted, operation is said to be automatic.



VARI-SPEED PULLEY

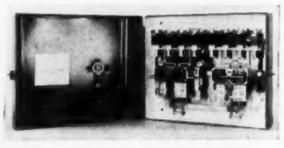
Reeves Pulley Co., Columbus, Ind., offers a new and improved countershaft-type vari-speed motor pulley. The pulley is characterized as a simple, compact variable-speed unit mounted on the standard shaft extension of any constant-speed motor to form a direct drive from motor to machine.



Through a hand-wheel control, a sliding base on which the motor and vari-speed unit are mounted is moved back and forth, varying the diameter of a set of adjustable disks from which a V-belt runs to the driven machine. For unusual speed reduction or increase, a countershaft is mounted on a common base with the rest of the unit. In the new design, the countershaft power take-off pulley may be mounted in the center of the countershaft instead of on the end, making a much more compact unit. In addition to a straight-face pulley, power also may be taken off from a sprocket, pinion, multiple V-belt, sheave or other accepted drive. The pulley is built in seven sizes transmitting up to 7½ hp. at speed ratios up to 3 : 1.

REVERSING STARTER

A new reversing motor starter, Type AP-7-R, for motors of 7½ hp., 550 volts, or less. is announced by the Condit Works, Allis-Chalmers Mfg. Co., Boston, Mass. The starter



consists of two Type AP-7 motor-starter units mechanically interlocked so that either unit cannot be closed if the other is closed. Starter units are equipped with "Ruptors," or inclosing chambers, said to confine and depotentiate the arc formed by circuit interruption, increasing interrupting ability and forming a barrier between contacts of like polarity.

RESPIRATOR COVERS

H. S. Cover, South Bend, Ind., offers "Nite-Cap" covers for respirators. "Nite-Caps," according to the company, are made of a fuzzy socklike material, and are designed to be drawn snugly over the filter apertures of a respirator to keep the filter pads free of excessive dust accumulations and thus prolong their effective life.

BLAST-HOLE DRILL

Bucyrus-Erie Co., South Milwaukee, Wis., offers the new Bucyrus-Armstrong 27-T blast-hole drill with a weight of 18,400 lb. and a tool capacity of 2,000 lb. Features cited by the company include, as regular or optional equipment: new built-in tool wrench; special bumper reel; large operator's platform and other operator conveniences; rubber-insulated tool guide and sheaves; rubber shock absorber under crown sheave; and a "fast, snappy, highly penetrating drilling action that actually makes savings of from 30 to 50 per cent in drilling costs." The new unit is available with 33- or 40-ft. derrick, caterpillar-type mounting and gasoline, diesel or electric power.